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DIVISION OF RANGE ANIMAL HUSBANDRY

Probability Tables for Mendelian Ratios With Small Numbers

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PROBABILITY TABLES FOR MENDELIAN RATIOS WITH SMALL NUMBERS

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With animal breeding involving the farm animals, it is usually impossible to raise a large number of progeny from any single pair of parents. Also, matings of the same kind involving different pairs of parents are frequently limited in the size of the progeny population, because of limitation of space and funds. When such breeding programs are complicated by lethal or sub-lethal factors or by other factors which reduce the viability of the offspring, it becomes especially difficult to produce large progeny populations.

There are two questions in the study of actual ratios of inherited characters. One is to decide which one of two or more possible Mendelian ratios is the true ratio for the data. This may be impossible, and we have to content ourselves with finding several ratios any of which may be the true ratio, and with finding which ratios are so highly improbable as to be dropped from consideration. The other question may be simply whether the actual numbers concerned are possible for a given hypothesis and still be within the range of chance due to sampling. The only difference between these two questions is that the process of reasoning to arrive at the answer to the second question, is repeated for all possible ratios to answer the first. Accordingly, it becomes highly important to learn the probabilities due to chance for all possible combinations when we have a definite Mendelian ratio involved.

The Mendelian ratios correspond to the numbers of black balls and white balls present in the urns long used in classical illustrations of probability by mathematicians. Thus the 1 to 1 ratio represents $\frac{1}{2}+\frac{1}{2}$; the 3 to 1, $\frac{3}{4}+\frac{1}{4}$; etc. The fundamental basis of these probabilities is the expansion of the binominal $(p+q)$ to the nth power where p and q represent fractions whose sum is 1 and n is the number in the sample. Thus, as example, we consider the 3 to 1 expectation the equivalent of an urn with black balls and white balls in infinite numbers, but in the proportion of $\frac{3}{4}$ black to $\frac{1}{4}$ white. The progeny of a mating with this expectation represents one trial, or sample. The number of progeny raised or the number of balls removed from the urn determines the range of possible combinations. If only one individual is raised, the probability of its showing the dominant character is obviously .7500 and of showing the recessive is .2500. However, if four are raised, we may have any of five possibile combinations. These are 4D + 0R, 3D + 1R, 2D + 2R, 1D + 3R, and 0D + 4R. Obviously the 3D + 1R combination is the most likely. The actual probabilities are found by

expanding the binomial $(3/4+1/4)^4$, which gives five terms corresponding with the above combinations. These together with the steps used in their calculation are given in Table 1.

Table 1. Calculation of probabilities for $(3/4+1/4)^4$.

D	R	Coefficients	Terms of expansion			Probability
4	0		$(3/4)^4$	$81/256$	$81/256$	.3164
3	1	4	$(3/4)^3(1/4)$	$4(27/64)(1/4)$	$108/256$	.4219
2	2	6	$(3/4)^2(1/4)^2$	$6(9/16)(1/16)$	$54/256$	.2109
1	3	4	$(3/4)(1/4)^3$	$4(3/4)(1/64)$	$12/256$	.0469
0	4		$(1/4)^4$	$1/256$	$1/256$	.0039
TOTAL						1.0000

In this illustration the coefficents are actually given in numbers, which may be determined by rules of algebra. However, as the numbers in the sample increase, the coefficients become unwieldy. Accordingly their logarithms are computed from Pearson's tables of logarithms of factorials (5). The coefficient is represented by $\frac{\lfloor n}{\lfloor r \, \lfloor n-r}$ or converted to our terms $\frac{\lfloor n}{\lfloor D \, \lfloor R}$ where n equals the number in the sample, D the number of dominants, and R the number of recessives in the combination. To get the logarithm of the coefficient, the logarithms of $\lfloor D$ and $\lfloor R$ are taken from Pearson's table, added together and the result subtracted from the logarithm of $\lfloor n$. The fractions are reduced to decimals before being raised. The logarithm of the decimal multiplied by the power, gives the logarithm of the fraction raised to that power. By simple multiplication a list is prepared for each fraction giving the logarithms of that fraction raised to the respective powers. With these at hand, the logarithms of the coefficient and of each of the fractions raised to their powers according to the combination, are added together. This is the logarithm of the probability for this particular combination. Table 2 shows the above steps for the example.

By resorting to the above methods, it becomes possible to make all the determinations with a high degree of accuracy. However, the method is still too tedious to be a practical method if all groups and combinations have to be computed each time used. For these reasons, other methods, less direct, are generally used in the interpretation of data involving Mendelian ratios. The standard deviation was applied to this type of material by Johannsen (3), but many workers in Genetics have used

Table 2. Calculation by the use of logarithms of probabilities for $(\frac{3}{4}+\frac{1}{4})^4$

D	R	Logarithms of coefficients	Fractions of terms	Logarithms of D fractions	Logarithms of R fractions	Logarithms of probability	Probability
4	0		$(.7500)^4$	9.5002452 −10		9.5002452 −10	.3164
3	1	.6020600	$(.7500)^3(.2500)$	9.6251839 −10	9.3979400 −10	9.6251839 −10	.4219
2	2	.7781513	$(.7500)^2(.2500)^2$	9.7501226 −10	8.7958800 −10	9.3241538 −10	.2109
1	3	.6020600	$(.7500)(.2500)^3$	9.8750613 −10	8.1938200 −10	8.6709413 −10	.0469
0	4		$(.2500)^4$		7.5917600 −10	7.5917600 −10	.0039
							1.0000

the formula converted to terms of the probable error ($.6745\sqrt{pqn}$) and tables of the probable errors of the common ratios have been prepared by Emerson (1). The Chi-square test, which is also used, will be referred to later. The less direct methods may be entirely satisfactory where the population is fairly large, but not with small samples. Even with the 1:1 ratio where we get the normal curve of distribution, when n is small there are small discrepancies between the results when we use the probable error and the actual expansion of $(\frac{1}{2}+\frac{1}{2})$ to the nth power. When the ratio is one which produces a skew curve, the difference may be great. The following example is given to show the discrepancy which results from the use of the probable error with a small sample. Suppose we have an expectation of 15D+1R and n is 26. The expected numbers would be 24.375D+1.625R with a probable error of ±.83. To determine the two points outside of which the probability is approximately 1 to 100 or .0100 we may multiply the probable error by 3.82 and first add the result to the expected number of recessives to get one of the points and then subtract it from the expected recessives to get the other point. However, one of these points would be —1.5456, which is an absurdity when speaking of living things. If we expand the binomial $(^{15}/_{16}+^{1}/_{16})^{26}$ by the use of logarithms, we can get the actual probability of each combination as shown in Table 3.

It is to be noted that the probability of getting any combination including 9 or more recessives is less than .00005. These probabilities are plotted as a curve with the so-called expected shown.

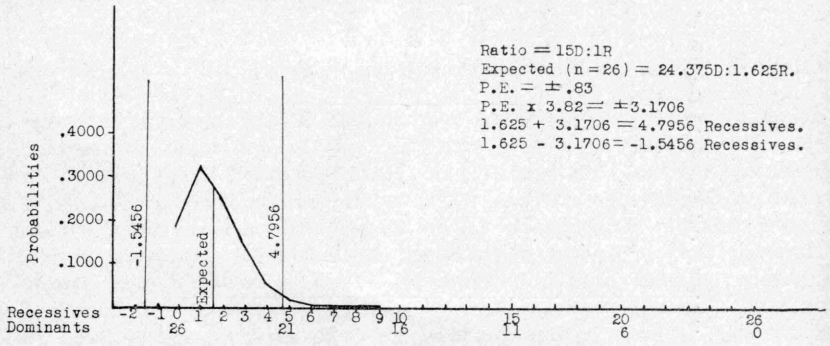

Fig. 1. Curve showing combinations and probabilities of $(^{15}/_{16}+^{1}/_{16})^{26}$

If we add the probabilities of the combinations outside the points represented by 3.82 times the probable error, we find that we cannot include any on the left-hand side of the expected. On the other side we find the point represented by 4.7956 recessives. As this is impossible biologically, we start with 5 recessives. Adding the probabilities of getting 5 or more recessives, we find that the total probability is .0208, or approximately odds of 1 to 48 instead of 1 to 100 as figured above from the probable error. Applying the Chi-square test to this example with the use of the tables as given by Fisher (2), we find the probability

less than .01, i. e., less than one chance in every 100 trials of this poor or poorer fit occurring. As seen above, this figure is not correct. Wilson and co-workers (7) have recently shown that the Chi-square test may not give true probabilities where the number of classes is small. They say, "Thus in many cases in which one actually uses the Chi-square test, it is desirable to be on one's guard against a too literal interpretation of the result, as the conditons implied in the proof of the test may not be adequately filled." This danger seems to be especially true when the sample is small and where there is a large difference in the size of the different expected classes. In the above example the so-called expected is 1.625 recessives and as this is impossible biologically the nearest whole number, which is two recessives, would be considered the most likely. It is seen from the probability figures that one recessive is the most probable number. So with small numbers the so-called expected may lead to error in interpretation rather than serving as a valuable aid as it does with large numbers. Examples with other small numbers could be given, but this should illustrate the points involved.

Table 3. Combinations and Probabilities of $(^{15}/_{16}+^{1}/_{16})^{26}$

Combination		Probability
D	R	
26	0	.1867
25	1	.3237
24	2	.2697
23	3	.1439
22	4	.0551
21	5	.0162
20	6	.0038
19	7	.0007
18	8	.0001
17	9	.0000
16	10	.0000
15	11	.0000
14	12	.0000
13	13	.0000
12	14	.0000
11	15	.0000
10	16	.0000
9	17	.0000
8	18	.0000
7	19	.0000
6	20	.0000
5	21	.0000
4	22	.0000
3	23	.0000
2	24	.0000
1	25	.0000
0	26	.0000
Total		.9999

Where the population is small the calculation of probability by the expansion of the binomial is preferrable for the following reasons:

1. Expected ratios are often fractions and when the numbers are small the rounding of the expected numbers to the nearest number biologically possible may give erroneous figures.

2. The multiplication of the probable error by a figure such as 3.0 to 4.0 frequently results in figures which when combined with the so-called expected give negative numbers.

3. Actual legitimate probabilities can be determined for any number, from 1 up, by the use of the expansion of the binomial.

4. The use of the binomial with the smaller numbers is peculiarly within the province of genetic interpretation because most Mendelian results must fall within a relatively few possible ratios.

We have calculated the probabilities for nine Mendelian ratios where n is 1 to 50. These are shown in Table 4. It will be noted that when n reaches a sufficient size so that the probability of getting n dominants +0 recessives in any ratio is less than .0001 the probabilities closely approach the normal curve of distribution. It is this fact that has long

been made use of in determining the probabilities from $\frac{\text{Dev.}}{\text{P. E.}}$ or from $\frac{\text{Dev.}}{\text{St. Dev.}}$. In either case the probability is determined from the area or areas of portions of the normal curve. Accordingly, we believe that where n is large enough so that the probability of n dominants +0 recessives is less than .0001, the probable error may be safely used. It is recognized that very slight errors may still be present when the probable error is used until n is considerably larger than this. However, these errors are so small that they are of slight importance.

The group of probabilities at each end of each expansion is set off in bold face type in Table 4 so as to show the point beyond which the total probability in that direction is .0050 or less. Thus the two points shown on each expansion mark the limits beyond which the combined probability is .0100 or less. In most work, if the actual distribution falls outside these limits, we should consider it as almost certain that this is not the true ratio.

In addition to the above, the limits of values corresponding to the limits denoted in bold face type in Table 4 have been determined for the four ratios not completed in Table 4. These values have been determined by locating the sizes of n at which the probabilities pass .0050 and so give us our limits the same as in Table 4. These changing points have been determined by taking representative values of n, determining the probabilities for the ends of the curve by expansion and so locating the points of change. These values have been completed up to the values of n where the probability of n dominants +0 recessives is less than .0001 for each of these ratios and are shown in Table 5.

In the preparation of these tables, the 7-place logarithmic tables of Von Vega (6) together with the table of logarithms of factorials of Pearson (5) have been used. Where n was larger than 1000, the formula of Forsyth, as given by Pearl (4), was used to get the logarithms of the factorials, enabling us to complete Table 5 with fairly accurate figures for these larger values of n.

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BIBLIOGRAPHY

1. Emerson, R. A. 1922. Mimeographed tables. Printed by Castle in "Outline for a Laboratory Course in Genetics" 1924. Harvard Univ. Press, Cambridge, Mass.

2. Fisher, R. A. 1930. Statistical Methods for Research Workers. 3rd edition. Oliver and Boyd, Edinburgh and London.

3. Johannsen, W. 1909. Elemente der exakten Erblichkeitslehre. G. Fischer. Jena.

4. Pearl, Raymond. 1930. Medical Biometry and Statistics. 2nd edition. W. B. Saunders Co., Philadelphia.

5. Pearson, Karl. 1924. Tables for Statisticians and Biometricians. Part I. 2nd edition. Cambridge University Press, Cambridge, England.

6. Von Vega. 1923. Logarithmic Tables. Bremiker's edition, reprint. G. E. Stechert & Co., N. Y.

7. Wilson, Edwin B., Hilferty, Margaret M., and Maher, Helen C. 1931. Goodness of Fit. Journal of the American Statistical Association. (N. S. No. 176) 26:443-448.

Table 4. *Probabilities of* Mendelian Ratios.

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D	Combination R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
1	0	.5000	.5625	.6667	.7500	.8125	.8750	.9375	.9844	.9961
0	1	.5000	.4375	.3333	.2500	.1875	.1250	.0625	.0156	.0039
		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	0	.2500	.3164	.4444	.5625	.6602	.7656	.8789	.9690	.9922
1	1	.5000	.4922	.4444	.3750	.3047	.2187	.1172	.0308	.0078
0	2	.2500	.1914	.1111	.0625	.0352	.0156	.0039	.0002	------
		1.0000	1.0000	.9999	1.0000	1.0001	.9999	1.0000	1.0000	1.0000
3	0	.1250	.1780	.2963	.4219	.5364	.6699	.8240	.9539	.9883
2	1	.3750	.4153	.4444	.4219	.3713	.2871	.1648	.0454	.0116
1	2	.3750	.3230	.2222	.1406	.0857	.0410	.0110	.0007	------
0	3	.1250	.0837	.0370	.0156	.0066	.0020	.0002	------	------
		1.0000	1.0000	.9999	1.0000	1.0000	1.0000	1.0000	1.0000	.9999
4	0	.0625	.1001	.1975	.3164	.4358	.5862	.7725	.9389	.9845
3	1	.2500	.3115	.3951	.4219	.4023	.3350	.2060	.0596	.0154
2	2	.3750	.3634	.2963	.2109	.1393	.0718	.0206	.0014	.0001
1	3	.2500	.1884	.0988	.0469	.0214	.0068	.0009	------	------
0	4	.0625	.0366	.0124	.0039	.0012	.0002	------	------	------
		1.0000	1.0000	1.0001	1.0000	1.0000	1.0000	1.0000	.9999	1.0000
5	0	.0313	.0563	.1317	.2373	.3541	.5129	.7242	.9243	.9806
4	1	.1563	.2190	.3292	.3955	.4086	.3664	.2414	.0734	.0192
3	2	.3125	.3407	.3292	.2637	.1886	.1047	.0322	.0023	.0002
2	3	.3125	.2650	.1646	.0879	.0435	.0150	.0021	------	------
1	4	.1563	.1030	.0412	.0146	.0050	.0011	.0001	------	------
0	5	.0313	.0160	.0041	.0010	.0002	------	------	------	------
		1.0002	1.0000	1.0000	1.0000	1.0000	1.0001	1.0000	1.0000	1.0000
6	0	.0156	.0317	.0878	.1780	.2877	.4488	.6789	.9098	.9768
5	1	.0938	.1478	.2634	.3560	.3984	.3847	.2716	.0867	.0230
4	2	.2344	.2874	.3292	.2966	.2298	.1374	.0453	.0034	.0002
3	3	.3125	.2981	.2195	.1318	.0707	.0262	.0040	.0001	------
2	4	.2344	.1739	.0823	.0330	.0122	.0028	.0002	------	------
1	5	.0938	.0541	.0165	.0044	.0011	.0002	------	------	------
0	6	.0156	.0070	.0014	.0002	------	------	------	------	------
		1.0001	1.0000	1.0001	1.0000	.9999	1.0001	1.0000	1.0000	1.0000
7	0	.0078	.0178	.0585	.1335	.2338	.3927	.6365	.8956	.9730

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
6 1	.0547	.0970	.2048	.3115	.3776	.3927	.2970	.0995	.0267
5 2	.1641	.2264	.3073	.3115	.2614	.1683	.0594	**.0047**	**.0003**
4 3	.2734	.2934	.2561	.1730	.1005	.0401	.0066	**.0001**	------
3 4	.2734	.2282	.1280	.0577	.0232	.0057	**.0004**	------	------
2 5	.1641	.1065	.0384	.0115	**.0032**	**.0005**	------	------	------
1 6	.0547	.0276	.0064	**.0013**	**.0002**	------	------	------	------
0 7	.0078	**.0031**	**.0005**	**.0001**	------	------	------	------	------
	1.0000	1.0000	1.0000	1.0001	.9999	1.0000	.9999	.9999	1.0000
8 0	**.0039**	.0100	.0390	.1001	.1899	.3436	.5967	.8816	.9692
7 1	.0313	.0624	.1561	.2670	.3506	.3927	.3182	.1120	.0304
6 2	.1094	.1698	.2731	.3115	.2832	.1963	.0743	.0062	**.0004**
5 3	.2187	.2641	.2731	.2076	.1307	.0561	.0099	**.0002**	------
4 4	.2734	.2567	.1707	.0865	.0377	.0100	**.0008**	------	------
3 5	.2187	.1598	.0683	.0231	.0070	**.0011**	------	------	------
2 6	.1094	.0621	.0171	**.0038**	**.0008**	**.0001**	------	------	------
1 7	.0313	.0138	**.0024**	**.0004**	**.0001**	------	------	------	------
0 8	**.0039**	**.0013**	**.0002**	------	------	------	------	------	------
	1.0000	1.0000	1.0000	1.0000	1.0000	.9999	.9999	1.0000	1.0000
9 0	**.0020**	.0056	.0260	.0751	.1543	.3007	.5594	.8678	.9654
8 1	.0176	.0395	.1171	.2253	.3205	.3866	.3357	.1240	.0341
7 2	.0703	.1228	.2341	.3003	.2958	.2209	.0895	.0079	**.0005**
6 3	.1641	.2228	.2731	.2336	.1593	.0736	.0139	**.0003**	------
5 4	.2461	.2600	.2048	.1168	.0551	.0158	**.0014**	------	------
4 5	.2461	.2022	.1024	.0389	.0127	**.0023**	**.0001**	------	------
3 6	.1641	.1048	.0341	.0087	**.0020**	**.0002**	------	------	------
2 7	.0703	.0350	.0073	**.0012**	**.0002**	------	------	------	------
1 8	.0176	.0068	**.0009**	**.0001**	------	------	------	------	------
0 9	**.0020**	**.0006**	**.0001**	------	------	------	------	------	------
	1.0002	1.0001	.9999	1.0000	.9999	1.0001	1.0000	1.0000	1.0000
10 0	**.0010**	**.0032**	.0173	.0563	.1254	.2631	.5245	.8543	.9616
9 1	.0098	.0247	.0867	.1877	.2893	.3758	.3496	.1356	.0377
8 2	.0440	.0863	.1951	.2816	.3005	.2416	.1049	.0097	**.0007**
7 3	.1172	.1790	.2601	.2503	.1849	.0920	.0186	**.0004**	------
6 4	.2051	.2437	.2276	.1460	.0747	.0231	**.0022**	------	------
5 5	.2461	.2275	.1366	.0584	.0207	**.0039**	**.0002**	------	------
4 6	.2051	.1474	.0569	.0162	**.0040**	**.0005**	------	------	------
3 7	.1172	.0655	.0163	**.0031**	**.0005**	------	------	------	------
2 8	.0440	.0191	**.0030**	**.0004**	------	------	------	------	------
1 9	.0098	**.0033**	**.0003**	------	------	------	------	------	------
0 10	**.0010**	**.0003**	------	------	------	------	------	------	------
	1.0003	1.0000	.9999	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
11 0	**.0005**	**.0018**	.0116	.0422	.1019	.2302	.4917	.8410	.9579
10 1	.0054	.0153	.0636	.1549	.2586	.3617	.3606	.1468	.0413
9 2	.0269	.0594	.1590	.2581	.2984	.2584	.1202	.0117	**.0008**
8 3	.0806	.1385	.2384	.2581	.2066	.1107	.0240	**.0006**	------
7 4	.1611	.2154	.2384	.1721	.0953	.0316	**.0032**	------	------
6 5	.2256	.2346	.1669	.0803	.0308	.0063	**.0003**	------	------
5 6	.2256	.1824	.0835	.0268	.0071	**.0009**	------	------	------
4 7	.1611	.1014	.0298	.0064	**.0012**	**.0001**	------	------	------
3 8	.0806	.0394	.0075	**.0011**	**.0001**	------	------	------	------
2 9	.0269	.0102	**.0012**	**.0001**	------	------	------	------	------
1 10	.0054	**.0016**	**.0001**	------	------	------	------	------	------
0 11	**.0005**	**.0001**	------	------	------	------	------	------	------
	1.0002	1.0001	1.0000	1.0001	1.0000	.9999	1.0000	1.0001	1.0000
12 0	**.0002**	**.0010**	.0077	.0317	.0828	.2014	.4610	.8278	.9541
11 1	**.0029**	.0094	.0462	.1267	.2291	.3453	.3688	.1577	.0449
10 2	.0161	.0401	.1272	.2323	.2909	.2713	.1352	.0138	**.0010**
9 3	.0537	.1039	.2120	.2581	.2238	.1292	.0300	**.0007**	------
8 4	.1208	.1818	.2384	.1936	.1162	.0415	**.0045**	------	------
7 5	.1934	.2262	.1908	.1032	.0429	**.0095**	**.0005**	------	------
6 6	.2256	.2052	.1113	.0401	.0115	**.0016**	------	------	------
5 7	.1934	.1368	.0477	.0115	**.0023**	**.0002**	------	------	------

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
4 8	.1208	.0665	.0149	.0024	.0003	———	———	———	———
3 9	.0537	.0230	.0033	.0004	———	———	———	———	———
2 10	.0161	.0054	.0005	———	———	———	———	———	———
1 11	.0029	.0008	———	———	———	———	———	———	———
0 12	.0002	———	———	———	———	———	———	———	———
	.9998	1.0001	1.0000	1.0000	.9998	1.0000	1.0000	1.0000	1.0000
13 0	.0001	.0006	.0051	.0238	.0673	.1762	.4321	.8149	.9504
12 1	.0016	.0057	.0334	.1029	.2018	.3273	.3745	.1681	.0485
11 2	.0095	.0266	.1002	.2059	.2794	.2805	.1498	.0160	.0011
10 3	.0349	.0760	.1837	.2517	.2364	.1470	.0366	.0009	———
9 4	.0873	.1477	.2296	.2097	.1364	.0525	.0061	———	———
8 5	.1571	.2068	.2067	.1258	.0566	.0135	.0007	———	———
7 6	.2095	.2144	.1378	.0559	.0174	.0026	.0001	———	———
6 7	.2095	.1668	.0689	.0186	.0040	.0004	———	———	———
5 8	.1571	.0973	.0258	.0047	.0007	———	———	———	———
4 9	.0873	.0420	.0072	.0009	.0001	———	———	———	———
3 10	.0349	.0131	.0014	.0001	———	———	———	———	———
2 11	.0095	.0028	.0002	———	———	———	———	———	———
1 12	.0016	.0004	———	———	———	———	———	———	———
0 13	.0001	———	———	———	———	———	———	———	———
	1.0000	1.0002	1.0000	1.0000	1.0001	1.0000	.9999	.9999	1.0000
14 0	.0001	.0003	.0034	.0178	.0546	.1542	.4051	.8021	.9467
13 1	.0009	.0035	.0240	.0832	.1765	.3084	.3781	.1783	.0520
12 2	.0056	.0175	.0779	.1802	.2648	.2864	.1639	.0184	.0013
11 3	.0222	.0544	.1559	.2402	.2444	.1637	.0437	.0012	———
10 4	.0611	.1163	.2143	.2202	.1551	.0643	.0080	.0001	———
9 5	.1222	.1809	.2143	.1468	.0716	.0184	.0011	———	———
8 6	.1833	.2111	.1607	.0734	.0248	.0039	.0001	———	———
7 7	.2095	.1876	.0919	.0280	.0065	.0006	———	———	———
6 8	.1833	.1277	.0402	.0082	.0013	.0001	———	———	———
5 9	.1222	.0662	.0134	.0018	.0002	———	———	———	———
4 10	.0611	.0257	.0033	.0003	———	———	———	———	———
3 11	.0222	.0073	.0006	———	———	———	———	———	———
2 12	.0056	.0014	.0001	———	———	———	———	———	———
1 13	.0009	.0002	———	———	———	———	———	———	———
0 14	.0001	———	———	———	———	———	———	———	———
	1.0003	1.0001	1.0000	1.0001	.9998	1.0000	1.0000	1.0001	1.0000
15 0	———	.0002	.0023	.0134	.0444	.1349	.3798	.7896	.9430
14 1	.0005	.0021	.0171	.0668	.1537	.2891	.3798	.1880	.0555
13 2	.0032	.0113	.0600	.1559	.2483	.2891	.1772	.0209	.0015
12 3	.0139	.0382	.1299	.2252	.2483	.1790	.0512	.0014	———
11 4	.0417	.0892	.1948	.2252	.1719	.0767	.0102	.0001	———
10 5	.0916	.1526	.2143	.1651	.0873	.0241	.0015	———	———
9 6	.1527	.1979	.1786	.0917	.0336	.0057	.0002	———	———
8 7	.1964	.1979	.1148	.0393	.0100	.0011	———	———	———
7 8	.1964	.1539	.0574	.0131	.0023	.0002	———	———	———
6 9	.1527	.0931	.0223	.0034	.0004	———	———	———	———
5 10	.0916	.0435	.0067	.0007	.0001	———	———	———	———
4 11	.0417	.0154	.0015	.0001	———	———	———	———	———
3 12	.0139	.0040	.0003	———	———	———	———	———	———
2 13	.0032	.0007	———	———	———	———	———	———	———
1 14	.0005	.0001	———	———	———	———	———	———	———
0 15	———	———	———	———	———	———	———	———	———
	1.0000	1.0001	1.0000	.9999	1.0003	.9999	.9999	1.0000	1.0000
16 0	———	.0001	.0015	.0100	.0361	.1181	.3561	.7773	.9393
15 1	.0002	.0013	.0122	.0535	.1332	.2699	.3798	.1974	.0589
14 2	.0018	.0073	.0457	.1336	.2305	.2891	.1899	.0235	.0017
13 3	.0085	.0265	.1066	.2079	.2483	.1928	.0591	.0017	———
12 4	.0278	.0669	.1732	.2252	.1862	.0895	.0128	.0001	———
11 5	.0667	.1249	.2078	.1802	.1031	.0307	.0020	———	———
10 6	.1222	.1781	.1905	.1101	.0436	.0080	.0003	———	———
9 7	.1746	.1979	.1361	.0524	.0144	.0016	———	———	———
8 8	.1964	.1731	.0765	.0197	.0037	.0003	———	———	———

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
7 9	.1746	.1197	.0340	.0058	**.0008**	------	------	------	------
6 10	.1222	.0652	.0119	**.0014**	**.0001**	------	------	------	------
5 11	.0667	.0277	**.0032**	**.0002**	------	------	------	------	------
4 12	.0278	.0090	**.0007**	------	------	------	------	------	------
3 13	.0085	**.0021**	**.0001**	------	------	------	------	------	------
2 14	**.0018**	**.0004**	------	------	------	------	------	------	------
1 15	**.0002**	------	------	------	------	------	------	------	------
0 16	------	------	------	------	------	------	------	------	------
	1.0000	1.0002	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	.9999
17 0	------	**.0001**	**.0010**	.0075	.0293	.1033	.3338	.7651	.9356
16 1	**.0001**	**.0007**	.0086	.0426	.1150	.2509	.3783	.2065	.0624
15 2	**.0010**	.0046	.0345	.1136	.2123	.2867	.2018	.0262	**.0020**
14 3	.0052	.0181	.0863	.1893	.2449	.2048	.0673	**.0021**	------
13 4	.0182	.0492	.1510	.2209	.1978	.1024	.0157	**.0001**	------
12 5	.0472	.0995	.1963	.1914	.1187	.0380	**.0027**	------	------
11 6	.0944	.1548	.1963	.1276	.0548	.0109	**.0004**	------	------
10 7	.1484	.1892	.1542	.0668	.0199	**.0024**	------	------	------
9 8	.1855	.1840	.0964	.0279	.0057	**.0004**	------	------	------
8 9	.1855	.1431	.0482	.0093	**.0013**	**.0001**	------	------	------
7 10	.1484	.0890	.0193	**.0025**	**.0002**	------	------	------	------
6 11	.0944	.0441	.0061	**.0005**	------	------	------	------	------
5 12	.0472	.0171	**.0015**	**.0001**	------	------	------	------	------
4 13	.0182	.0051	**.0003**	------	------	------	------	------	------
3 14	.0052	**.0011**	------	------	------	------	------	------	------
2 15	**.0010**	**.0002**	------	------	------	------	------	------	------
1 16	**.0001**	------	------	------	------	------	------	------	------
0 17	------	------	------	------	------	------	------	------	------
	1.0000	.9999	1.0000	1.0000	.9999	.9999	1.0000	1.0000	1.0000
18 0	------	------	**.0007**	.0056	.0238	.0904	.3130	.7532	.9320
17 1	**.0001**	**.0004**	.0061	.0338	.0989	.2324	.3755	.2152	.0658
16 2	**.0006**	**.0029**	.0259	.0958	.1940	.2823	.2128	.0290	**.0022**
15 3	**.0031**	.0122	.0690	.1704	.2388	.2151	.0757	**.0025**	------
14 4	.0117	.0356	.1294	.2130	.2067	.1152	.0189	**.0001**	------
13 5	.0327	.0775	.1812	.1988	.1335	.0461	**.0035**	------	------
12 6	.0708	.1306	.1963	.1436	.0668	.0143	**.0005**	------	------
11 7	.1214	.1742	.1682	.0820	.0264	**.0035**	**.0001**	------	------
10 8	.1669	.1863	.1157	.0376	.0084	**.0007**	------	------	------
9 9	.1855	.1610	.0643	.0139	**.0021**	**.0001**	------	------	------
8 10	.1669	.1127	.0289	.0042	**.0004**	------	------	------	------
7 11	.1214	.0637	.0105	**.0010**	**.0001**	------	------	------	------
6 12	.0708	.0289	**.0031**	**.0002**	------	------	------	------	------
5 13	.0327	.0104	**.0007**	------	------	------	------	------	------
4 14	.0117	**.0029**	**.0001**	------	------	------	------	------	------
3 15	**.0031**	**.0006**	------	------	------	------	------	------	------
2 16	**.0006**	**.0001**	------	------	------	------	------	------	------
1 17	**.0001**	------	------	------	------	------	------	------	------
0 18	------	------	------	------	------	------	------	------	------
	1.0001	1.0000	1.0001	.9999	.9999	1.0001	1.0000	1.0000	1.0000
19 0	------	------	**.0005**	**.0042**	.0193	.0791	.2934	.7414	.9283
18 1	------	**.0003**	**.0043**	.0268	.0848	.2147	.3716	.2236	.0692
17 2	**.0003**	**.0018**	.0193	.0803	.1762	.2760	.2230	.0319	**.0024**
16 3	**.0018**	.0082	.0546	.1517	.2304	.2235	.0842	**.0029**	**.0001**
15 4	.0074	.0254	.1093	.2023	.2127	.1277	.0225	**.0002**	------
14 5	.0222	.0592	.1639	.2023	.1472	.0547	.0045	------	------
13 6	.0518	.1074	.1912	.1574	.0793	.0182	**.0007**	------	------
12 7	.0961	.1551	.1776	.0974	.0340	.0048	**.0001**	------	------
11 8	.1442	.1810	.1332	.0487	.0118	**.0010**	------	------	------
10 9	.1762	.1720	.0814	.0198	**.0033**	**.0002**	------	------	------
9 10	.1762	.1338	.0407	.0066	**.0008**	------	------	------	------
8 11	.1442	.0851	.0166	**.0018**	**.0001**	------	------	------	------
7 12	.0961	.0442	.0055	**.0004**	------	------	------	------	------
6 13	.0518	.0185	**.0015**	**.0001**	------	------	------	------	------
5 14	.0222	.0062	**.0003**	------	------	------	------	------	------
4 15	.0074	**.0016**	**.0001**	------	------	------	------	------	------
3 16	**.0018**	**.0003**	------	------	------	------	------	------	------
2 17	**.0003**	------	------	------	------	------	------	------	------

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
				Mendelian Ratios					
1 18	.....	.....	.....	.....	.....	.....	.....	.....	.....
0 19	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0000	1.0001	1.0000	.9998	.9999	.9999	1.0000	1.0000	1.0000
20 0	.....	.....	**.0003**	**.0032**	.0157	.0692	.2751	.7298	.9247
19 1	.....	**.0002**	**.0030**	.0211	.0726	.1977	.3667	.2317	.0725
18 2	**.0002**	**.0012**	.0143	.0670	.1591	.2684	.2323	.0349	**.0027**
17 3	**.0011**	.0054	.0429	.1339	.2202	.2300	.0929	**.0033**	**.0001**
16 4	.0046	.0178	.0911	.1897	.2160	.1397	.0263	**.0002**	.....
15 5	.0148	.0444	.1457	.2023	.1595	.0638	.0056	.....	.....
14 6	.0370	.0863	.1821	.1686	.0920	.0228	**.0009**	.....	.....
13 7	.0739	.1342	.1821	.1124	.0425	.0065	**.0001**	.....	.....
12 8	.1201	.1697	.1480	.0609	.0159	**.0015**	.....	.....	.....
11 9	.1602	.1759	.0987	.0271	.0049	**.0003**	.....	.....	.....
10 10	.1762	.1505	.0543	.0099	**.0012**	.....	.....	.....	.....
9 11	.1602	.1064	.0247	**.0030**	**.0003**	.....	.....	.....	.....
8 12	.1201	.0621	.0092	**.0008**	.....	.....	.....	.....	.....
7 13	.0739	.0297	**.0028**	**.0002**	.....	.....	.....	.....	.....
6 14	.0370	.0116	**.0007**	.....	.....	.....	.....	.....	.....
5 15	.0148	**.0036**	**.0001**	.....	.....	.....	.....	.....	.....
4 16	.0046	**.0009**	.....	.....	.....	.....	.....	.....	.....
3 17	**.0011**	**.0002**	.....	.....	.....	.....	.....	.....	.....
2 18	**.0002**	.....	.....	.....	.....	.....	.....	.....	.....
1 19	.....	.....	.....	.....	.....	.....	.....	.....	.....
0 20	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0000	1.0001	1.0000	1.0001	.9999	.9999	.9999	.9999	1.0000
21 0	.....	.....	**.0002**	**.0024**	.0128	.0606	.2579	.7184	.9211
20 1	.....	**.0001**	**.0021**	.0166	.0619	.1817	.3610	.2395	.0759
19 2	**.0001**	**.0007**	.0105	.0555	.1428	.2595	.2407	.0380	**.0030**
18 3	**.0006**	**.0035**	.0333	.1172	.2088	.2348	.1016	**.0038**	**.0001**
17 4	**.0029**	.0124	.0750	.1757	.2168	.1510	.0305	**.0003**	.....
16 5	.0097	.0328	.1275	.1992	.1701	.0733	.0069	.....	.....
15 6	.0259	.0680	.1700	.1770	.1047	.0279	**.0012**	.....	.....
14 7	.0555	.1133	.1821	.1265	.0518	.0086	**.0002**	.....	.....
13 8	.0970	.1542	.1594	.0738	.0209	**.0021**	.....	.....	.....
12 9	.1402	.1732	.1151	.0355	.0070	**.0004**	.....	.....	.....
11 10	.1682	.1616	.0691	.0142	**.0019**	**.0001**	.....	.....	.....
10 11	.1682	.1257	.0345	.0047	**.0004**	.....	.....	.....	.....
9 12	.1402	.0815	.0144	**.0013**	**.0001**	.....	.....	.....	.....
8 13	.0970	.0439	.0050	**.0003**	.....	.....	.....	.....	.....
7 14	.0555	.0195	**.0014**	**.0001**	.....	.....	.....	.....	.....
6 15	.0259	.0071	**.0003**	.....	.....	.....	.....	.....	.....
5 16	.0097	**.0021**	**.0001**	.....	.....	.....	.....	.....	.....
4 17	**.0029**	**.0005**	.....	.....	.....	.....	.....	.....	.....
3 18	**.0006**	**.0001**	.....	.....	.....	.....	.....	.....	.....
2 19	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
1 20	.....	.....	.....	.....	.....	.....	.....	.....	.....
0 21	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0002	1.0002	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0001
22 0	.....	.....	**.0001**	**.0018**	.0104	.0530	.2418	.7072	.9175
21 1	.....	**.0001**	**.0015**	.0131	.0527	.1665	.3546	.2470	.0792
20 2	**.0001**	**.0004**	.0077	.0458	.1277	.2498	.2482	.0412	**.0033**
19 3	**.0004**	**.0023**	.0257	.1017	.1964	.2379	.1103	**.0044**	**.0001**
18 4	**.0017**	.0085	.0611	.1611	.2153	.1614	.0349	**.0003**	.....
17 5	.0063	.0239	.1100	.1933	.1789	.0830	.0084	.....	.....
16 6	.0178	.0526	.1558	.1826	.1169	.0336	**.0016**	.....	.....
15 7	.0407	.0934	.1781	.1391	.0617	.0110	**.0002**	.....	.....
14 8	.0762	.1363	.1670	.0869	.0267	**.0029**	.....	.....	.....
13 9	.1186	.1649	.1299	.0451	.0096	**.0007**	.....	.....	.....
12 10	.1542	.1667	.0844	.0195	**.0029**	**.0001**	.....	.....	.....
11 11	.1682	.1414	.0460	.0071	**.0007**	.....	.....	.....	.....
10 12	.1542	.1008	.0211	**.0022**	**.0002**	.....	.....	.....	.....
9 13	.1186	.0603	.0081	**.0006**	.....	.....	.....	.....	.....
8 14	.0762	.0302	**.0026**	**.0001**	.....	.....	.....	.....	.....
7 15	.0407	.0125	**.0007**	.....	.....	.....	.....	.....	.....
6 16	.0178	.0043	**.0002**	.....	.....	.....	.....	.....	.....

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
5 17	.0063	**.0012**	------	------	------	------	------	------	------
4 18	**.0017**	**.0003**	------	------	------	------	------	------	------
3 19	**.0004**	------	------	------	------	------	------	------	------
2 20	**.0001**	------	------	------	------	------	------	------	------
1 21	------	------	------	------	------	------	------	------	------
0 22	------	------	------	------	------	------	------	------	------
	1.0002	1.0001	1.0000	1.0000	1.0001	.9999	1.0000	1.0001	1.0001
23 0	------	------	**.0001**	**.0013**	.0084	.0464	.2266	.6961	.9139
22 1	------	------	**.0010**	.0103	.0448	.1523	.3475	.2541	.0824
21 2	------	**.0003**	.0056	.0376	.1136	.2394	.2548	.0444	**.0036**
20 3	**.0002**	**.0015**	.0197	.0878	.1835	.2394	.1189	.0049	**.0001**
19 4	**.0011**	.0058	.0493	.1463	.2118	.1710	.0396	**.0004**	------
18 5	.0040	.0171	.0937	.1853	.1857	.0928	.0100	------	------
17 6	.0120	.0400	.1405	.1853	.1286	.0398	**.0020**	------	------
16 7	.0292	.0756	.1707	.1500	.0720	.0138	**.0003**	------	------
15 8	.0585	.1175	.1707	.1000	.0333	**.0039**	------	------	------
14 9	.0974	.1523	.1422	.0555	.0128	**.0009**	------	------	------
13 10	.1364	.1659	.0996	.0259	.0041	**.0002**	------	------	------
12 11	.1612	.1525	.0588	.0102	**.0011**	------	------	------	------
11 12	.1612	.1186	.0294	**.0034**	**.0003**	------	------	------	------
10 13	.1364	.0780	.0124	**.0010**	------	------	------	------	------
9 14	.0974	.0434	.0044	**.0002**	------	------	------	------	------
8 15	.0585	.0202	**.0013**	------	------	------	------	------	------
7 16	.0292	.0079	**.0003**	------	------	------	------	------	------
6 17	.0120	**.0025**	**.0001**	------	------	------	------	------	------
5 18	.0040	**.0007**	------	------	------	------	------	------	------
4 19	**.0011**	**.0001**	------	------	------	------	------	------	------
3 20	**.0002**	------	------	------	------	------	------	------	------
2 21	------	------	------	------	------	------	------	------	------
1 22	------	------	------	------	------	------	------	------	------
0 23	------	------	------	------	------	------	------	------	------
	1.0000	.9999	.9998	1.0001	1.0000	.9999	.9997	.9999	1.0000
24 0	------	------	**.0001**	**.0010**	.0069	.0406	.2125	.6853	.9103
23 1	------	------	**.0007**	.0080	.0379	.1391	.3400	.2610	.0857
22 2		**.0002**	**.0041**	.0308	.1007	.2285	.2606	.0477	**.0039**
21 3	**.0001**	**.0010**	.0150	.0752	.1704	.2394	.1274	.0055	**.0001**
20 4	**.0006**	.0039	.0395	.1316	.2065	.1795	.0446	**.0005**	------
19 5	**.0025**	.0122	.0789	.1755	.1906	.1026	.0119	------	------
18 6	.0080	.0300	.1249	.1853	.1393	.0464	**.0025**	------	------
17 7	.0206	.0600	.1606	.1588	.0826	.0171	**.0004**	------	------
16 8	.0438	.0992	.1707	.1125	.0405	.0052	**.0001**	------	------
15 9	.0779	.1371	.1517	.0667	.0166	**.0013**	------	------	------
14 10	.1169	.1600	.1138	.0333	.0058	**.0003**	------	------	------
13 11	.1488	.1584	.0724	.0141	**.0017**	**.0001**	------	------	------
12 12	.1612	.1334	.0392	.0051	**.0004**	------	------	------	------
11 13	.1488	.0958	.0181	**.0016**	**.0001**	------	------	------	------
10 14	.1169	.0585	.0071	**.0004**	------	------	------	------	------
9 15	.0779	.0304	**.0024**	**.0001**	------	------	------	------	------
8 16	.0438	.0133	**.0007**	------	------	------	------	------	------
7 17	.0206	.0049	**.0002**	------	------	------	------	------	------
6 18	.0080	**.0015**	------	------	------	------	------	------	------
5 19	**.0025**	**.0004**	------	------	------	------	------	------	------
4 20	**.0006**	**.0001**	------	------	------	------	------	------	------
3 21	**.0001**	------	------	------	------	------	------	------	------
2 22	------	------	------	------	------	------	------	------	------
1 23	------	------	------	------	------	------	------	------	------
0 24	------	------	------	------	------	------	------	------	------
	.9996	1.0003	1.0001	1.0000	1.0000	1.0001	1.0000	1.0000	1.0000
25 0	------	------	------	**.0008**	.0056	.0355	.1992	.6745	**.9068**
24 1	------	------	**.0005**	.0063	.0321	.1268	.3320	.2677	.0889
23 2	------	**.0001**	**.0030**	.0251	.0889	.2173	.2656	.0510	**.0042**
22 3	**.0001**	**.0006**	.0114	.0641	.1573	.2380	.1357	.0062	**.0001**
21 4	**.0004**	**.0026**	.0313	.1175	.1997	.1870	.0498	**.0005**	------
20 5	**.0016**	.0086	.0658	.1645	.1936	.1122	.0139	------	------
19 6	.0053	.0222	.1096	.1828	.1489	.0534	**.0031**	------	------

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
18 7	.0143	.0469	.1487	.1654	.0933	.0207	**.0006**	------	------
17 8	.0322	.0820	.1673	.1241	.0484	.0067	**.0001**	------	------
16 9	.0609	.1205	.1580	.0781	.0211	**.0018**	------	------	------
15 10	.0974	.1500	.1264	.0417	.0078	**.0004**	------	------	------
14 11	.1328	.1591	.0862	.0189	**.0025**	**.0001**	------	------	------
13 12	.1550	.1443	.0503	.0074	**.0007**	------	------	------	------
12 13	.1550	.1123	.0251	**.0025**	**.0002**	------	------	------	------
11 14	.1328	.0748	.0108	**.0007**	------	------	------	------	------
10 15	.0974	.0427	.0040	**.0002**	------	------	------	------	------
9 16	.0609	.0208	**.0012**	------	------	------	------	------	------
8 17	.0322	.0085	**.0003**	------	------	------	------	------	------
7 18	.0143	**.0030**	**.0001**	------	------	------	------	------	------
6 19	.0053	**.0008**	------	------	------	------	------	------	------
5 20	**.0016**	**.0002**	------	------	------	------	------	------	------
4 21	**.0004**	------	------	------	------	------	------	------	------
3 22	**.0001**	------	------	------	------	------	------	------	------
2 23	------	------	------	------	------	------	------	------	------
1 24	------	------	------	------	------	------	------	------	------
0 25	------	------	------	------	------	------	------	------	------
	1.0000	1.0000	1.0000	1.0001	1.0001	.9999	1.0000	.9999	1.0000
26 0	------	------	------	**.0006**	**.0046**	.0311	.1867	.6640	.9032
25 1	------	------	**.0003**	.0049	.0271	.1154	.3237	.2740	.0921
24 2	------	**.0001**	**.0021**	.0204	.0783	.2060	.2697	.0544	**.0045**
23 3	------	**.0004**	.0086	.0544	.1445	.2354	.1439	.0069	**.0001**
22 4	**.0002**	**.0017**	.0247	.1042	.1918	.1934	.0551	**.0006**	------
21 5	**.0010**	.0060	.0543	.1528	.1947	.1216	.0162	------	------
20 6	**.0034**	.0162	.0950	.1782	.1573	.0608	**.0038**	------	------
19 7	.0098	.0361	.1357	.1698	.1037	.0248	**.0007**	------	------
18 8	.0233	.0667	.1611	.1344	.0568	.0084	**.0001**	------	------
17 9	.0466	.1037	.1611	.0896	.0262	**.0024**	------	------	------
16 10	.0792	.1371	.1370	.0508	.0103	**.0006**	------	------	------
15 11	.1151	.1551	.0996	.0246	**.0035**	**.0001**	------	------	------
14 12	.1439	.1508	.0623	.0103	**.0010**	------	------	------	------
13 13	.1550	.1263	.0335	.0037	**.0002**	------	------	------	------
12 14	.1439	.0912	.0156	**.0011**	**.0001**	------	------	------	------
11 15	.1151	.0568	.0062	**.0003**	------	------	------	------	------
10 16	.0792	.0304	**.0021**	**.0001**	------	------	------	------	------
9 17	.0466	.0139	**.0006**	------	------	------	------	------	------
8 18	.0233	.0054	**.0002**	------	------	------	------	------	------
7 19	.0098	**.0018**	------	------	------	------	------	------	------
6 20	**.0034**	**.0005**	------	------	------	------	------	------	------
5 21	**.0010**	**.0001**	------	------	------	------	------	------	------
4 22	**.0002**	------	------	------	------	------	------	------	------
3 23	------	------	------	------	------	------	------	------	------
2 24	------	------	------	------	------	------	------	------	------
	1.0000	1.0003	1.0000	1.0002	1.0001	1.0000	.9999	.9999	.9999
27 0	------	------	------	**.0004**	**.0037**	.0272	.1751	.6536	.8997
26 1	------	------	**.0002**	**.0038**	.0229	.1048	.3151	.2801	.0953
25 2	------	------	**.0015**	.0165	.0687	.1947	.2731	.0578	.0049
24 3	------	**.0002**	.0064	.0459	.1321	.2318	.1517	.0076	**.0002**
23 4	**.0001**	**.0012**	.0193	.0917	.1829	.1987	.0607	**.0007**	------
22 5	**.0006**	.0041	.0444	.1406	.1942	.1305	.0186	**.0001**	------
21 6	**.0022**	.0117	.0814	.1719	.1643	.0684	.0045	------	------
20 7	.0066	.0274	.1221	.1719	.1137	.0293	**.0009**	------	------
19 8	.0165	.0533	.1526	.1432	.0656	.0105	**.0002**	------	------
18 9	.0349	.0875	.1611	.1008	.0320	**.0032**	------	------	------
17 10	.0629	.1225	.1450	.0605	.0133	**.0008**	------	------	------
16 11	.0971	.1472	.1121	.0312	.0047	**.0002**	------	------	------
15 12	.1295	.1527	.0747	.0139	**.0015**	------	------	------	------
14 13	.1494	.1370	.0431	.0053	**.0004**	------	------	------	------
13 14	.1494	.1066	.0216	**.0018**	**.0001**	------	------	------	------
12 15	.1295	.0718	.0093	**.0005**	------	------	------	------	------
11 16	.0971	.0419	**.0035**	**.0001**	------	------	------	------	------
10 17	.0629	.0211	**.0011**	------	------	------	------	------	------
9 18	.0349	.0091	**.0003**	------	------	------	------	------	------
8 19	.0165	**.0034**	**.0001**	------	------	------	------	------	------

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
7 20	.0066	**.0010**	------	------	------	------	------	------	------
6 21	**.0022**	**.0003**	------	------	------	------	------	------	------
5 22	**.0006**	**.0001**	------	------	------	------	------	------	------
4 23	**.0001**	------	------	------	------	------	------	------	------
3 24	------	------	------	------	------	------	------	------	------
2 25	------	------	------	------	------	------	------	------	------
	.9996	1.0001	.9998	1.0000	1.0001	1.0001	.9999	.9999	1.0001
28 0	------	------	------	**.0003**	**.0030**	.0238	.1641	.6434	.8962
27 1	------	------	**.0002**	**.0030**	.0193	.0951	.3064	.2860	.0984
26 2	------	------	**.0011**	.0133	.0601	.1835	.2757	.0613	.0052
25 3	------	**.0002**	.0048	.0385	.1202	.2271	.1593	.0084	**.0002**
24 4	**.0001**	**.0008**	.0150	.0803	.1734	.2028	.0664	**.0008**	------
23 5	**.0004**	**.0028**	.0360	.1284	.1920	.1391	.0212	**.0001**	------
22 6	**.0014**	.0084	.0691	.1641	.1699	.0762	.0054	------	------
21 7	.0044	.0201	.1085	.1719	.1232	.0342	**.0011**	------	------
20 8	.0116	.0420	.1425	.1504	.0746	.0128	**.0002**	------	------
19 9	.0257	.0725	.1583	.1114	.0383	.0041	------	------	------
18 10	.0489	.1072	.1504	.0706	.0168	**.0011**	------	------	------
17 11	.0800	.1364	.1230	.0385	.0063	**.0003**	------	------	------
16 12	.1133	.1503	.0872	.0182	**.0021**	**.0001**	------	------	------
15 13	.1395	.1439	.0536	.0075	**.0006**	------	------	------	------
14 14	.1494	.1199	.0287	**.0027**	**.0001**	------	------	------	------
13 15	.1395	.0870	.0134	**.0008**	------	------	------	------	------
12 16	.1133	.0550	.0054	**.0002**	------	------	------	------	------
11 17	.0800	.0302	**.0019**	**.0001**	------	------	------	------	------
10 18	.0489	.0144	**.0006**	------	------	------	------	------	------
9 19	.0257	.0059	**.0002**	------	------	------	------	------	------
8 20	.0116	**.0021**	------	------	------	------	------	------	------
7 21	.0044	**.0006**	------	------	------	------	------	------	------
6 22	**.0014**	**.0002**	------	------	------	------	------	------	------
5 23	**.0004**	------	------	------	------	------	------	------	------
4 24	**.0001**	------	------	------	------	------	------	------	------
3 25	------	------	------	------	------	------	------	------	------
2 26	------	------	------	------	------	------	------	------	------
	1.0000	.9999	.9999	1.0002	.9999	1.0002	.9998	1.0000	1.0000
29 0	------	------	------	**.0002**	**.0024**	.0208	.1539	.6334	.8927
28 1	------	------	**.0001**	**.0023**	.0162	.0862	.2975	.2915	.1015
27 2	------	------	**.0008**	.0107	.0525	.1724	.2777	.0648	.0056
26 3	------	**.0001**	**.0036**	.0322	.1089	.2217	.1666	.0093	**.0002**
25 4	------	**.0005**	.0116	.0698	.1634	.2058	.0722	**.0010**	------
24 5	**.0002**	**.0019**	.0290	.1164	.1885	.1470	.0241	**.0001**	------
23 6	**.0009**	.0060	.0580	.1552	.1740	.0840	.0064	------	------
22 7	**.0029**	.0152	.0954	.1699	.1320	.0394	**.0014**	------	------
21 8	.0080	.0326	.1312	.1558	.0838	.0155	**.0003**	------	------
20 9	.0187	.0591	.1530	.1212	.0451	.0052	------	------	------
19 10	.0373	.0920	.1530	.0808	.0208	**.0015**	------	------	------
18 11	.0644	.1236	.1321	.0465	.0083	**.0004**	------	------	------
17 12	.0967	.1442	.0991	.0233	**.0029**	**.0001**	------	------	------
16 13	.1264	.1467	.0648	.0101	**.0009**	------	------	------	------
15 14	.1445	.1304	.0370	.0039	**.0002**	------	------	------	------
14 15	.1445	.1014	.0185	**.0013**	**.0001**	------	------	------	------
13 16	.1264	.0690	.0081	**.0004**	------	------	------	------	------
12 17	.0967	.0410	**.0031**	**.0001**	------	------	------	------	------
11 18	.0644	.0213	**.0010**	------	------	------	------	------	------
10 19	.0373	.0096	**.0003**	------	------	------	------	------	------
9 20	.0187	.0037	**.0001**	------	------	------	------	------	------
8 21	.0080	**.0012**	------	------	------	------	------	------	------
7 22	**.0029**	**.0004**	------	------	------	------	------	------	------
6 23	**.0009**	**.0001**	------	------	------	------	------	------	------
5 24	**.0002**	------	------	------	------	------	------	------	------
4 25	------	------	------	------	------	------	------	------	------
3 26	------	------	------	------	------	------	------	------	------
	1.0000	1.0000	.9998	1.0001	1.0000	1.0000	1.0001	1.0001	1.0000
30 0	------	------	------	**.0002**	**.0020**	.0182	.1443	.6235	.8892
29 1	------	------	**.0001**	**.0018**	.0137	.0780	.2885	.2969	.1046

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
28 2	.....	.....	**.0006**	.0086	.0457	.1616	.2789	.0683	.0059
27 3	.....	**.0001**	**.0026**	.0269	.0984	.2155	.1735	.0101	**.0002**
26 4	.....	**.0003**	.0089	.0604	.1532	.2078	.0781	**.0011**	.....
25 5	**.0001**	**.0013**	.0232	.1047	.1838	.1544	.0271	**.0001**	.....
24 6	**.0006**	.0042	.0484	.1455	.1768	.0919	.0075	.....	.....
23 7	**.0019**	.0112	.0829	.1662	.1399	.0450	**.0017**	.....	.....
22 8	.0055	.0250	.1192	.1593	.0928	.0185	**.0003**	.....	.....
21 9	.0133	.0475	.1457	.1298	.0523	.0065	**.0001**	.....	.....
20 10	.0280	.0776	.1530	.0909	.0254	**.0019**	.....	.....	.....
19 11	.0509	.1098	.1391	.0551	.0106	**.0005**	.....	.....	.....
18 12	.0806	.1352	.1101	.0291	.0039	**.0001**	.....	.....	.....
17 13	.1115	.1456	.0762	.0134	**.0012**	.....	.....	.....	.....
16 14	.1354	.1375	.0463	.0054	**.0003**	.....	.....	.....	.....
15 15	.1445	.1141	.0247	**.0019**	**.0001**	.....	.....	.....	.....
14 16	.1354	.0832	.0116	**.0006**	.....	.....	.....	.....	.....
13 17	.1115	.0533	.0048	**.0002**	.....	.....	.....	.....	.....
12 18	.0806	.0299	**.0017**	.....	.....	.....	.....	.....	.....
11 19	.0509	.0147	**.0005**	.....	.....	.....	.....	.....	.....
10 20	.0280	.0063	**.0001**	.....	.....	.....	.....	.....	.....
9 21	.0133	**.0023**	.....	.....	.....	.....	.....	.....	.....
8 22	.0055	**.0007**	.....	.....	.....	.....	.....	.....	.....
7 23	**.0019**	**.0002**	.....	.....	.....	.....	.....	.....	.....
6 24	**.0006**	.....	.....	.....	.....	.....	.....	.....	.....
5 25	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
4 26	.....	.....	.....	.....	.....	.....	.....	.....	.....
3 27	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0001	1.0000	.9997	1.0000	1.0001	.9999	1.0000	1.0000	.9999
31 0	.....	.....	.....	**.0001**	**.0016**	.0159	.1352	.6137	.8857
30 1	.....	.....	**.0001**	**.0014**	.0115	.0706	.2795	.3020	.1077
29 2	.....	.....	**.0004**	.0069	.0397	.1512	.2795	.0719	.0063
28 3	.....	.....	**.0020**	.0223	.0885	.2088	.1801	.0110	**.0002**
27 4	.....	**.0002**	.0068	.0520	.1429	.2088	.0841	**.0012**	.....
26 5	**.0001**	**.0009**	.0185	.0937	.1781	.1611	.0303	**.0001**	.....
25 6	**.0003**	**.0029**	.0400	.1353	.1781	.0997	.0087	.....	.....
24 7	**.0012**	.0081	.0714	.1610	.1468	.0509	**.0021**	.....	.....
23 8	.0037	.0190	.1071	.1610	.1016	.0218	**.0004**	.....	.....
22 9	.0094	.0377	.1369	.1372	.0599	.0080	**.0001**	.....	.....
21 10	.0207	.0645	.1506	.1006	.0304	**.0025**	.....	.....	.....
20 11	.0394	.0957	.1437	.0640	.0134	**.0007**	.....	.....	.....
19 12	.0657	.1241	.1198	.0356	.0052	**.0002**	.....	.....	.....
18 13	.0960	.1410	.0875	.0173	**.0017**	.....	.....	.....	.....
17 14	.1235	.1410	.0563	.0074	**.0005**	.....	.....	.....	.....
16 15	.1399	.1243	.0319	**.0028**	**.0001**	.....	.....	.....	.....
15 16	.1399	.0967	.0160	**.0009**	.....	.....	.....	.....	.....
14 17	.1235	.0664	.0070	**.0003**	.....	.....	.....	.....	.....
13 18	.0960	.0401	**.0027**	**.0001**	.....	.....	.....	.....	.....
12 19	.0657	.0214	**.0009**	.....	.....	.....	.....	.....	.....
11 20	.0394	.0100	**.0003**	.....	.....	.....	.....	.....	.....
10 21	.0207	.0041	**.0001**	.....	.....	.....	.....	.....	.....
9 22	.0094	**.0014**	.....	.....	.....	.....	.....	.....	.....
8 23	.0037	**.0004**	.....	.....	.....	.....	.....	.....	.....
7 24	**.0012**	**.0001**	.....	.....	.....	.....	.....	.....	.....
6 25	**.0003**	.....	.....	.....	.....	.....	.....	.....	.....
5 26	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
4 27	.....	.....	.....	.....	.....	.....	.....	.....	.....
3 28	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.9998	1.0000	1.0000	.9999	1.0000	1.0002	1.0000	.9999	.9999
32 0	.....	.....	.....	**.0001**	**.0013**	.0139	.1268	.6041	.8823
31 1	.....	.....	.....	**.0011**	.0096	.0637	.2705	.3069	.1107
30 2	.....	.....	**.0003**	.0055	.0344	.1411	.2795	.0755	.0067
29 3	.....	.....	**.0014**	.0185	.0793	.2016	.1863	.0120	**.0003**
28 4	.....	**.0001**	.0052	.0446	.1327	.2088	.0901	**.0014**	.....
27 5	.....	**.0006**	.0146	.0833	.1715	.1670	.0336	**.0001**	.....
26 6	**.0002**	**.0022**	.0328	.1249	.1781	.1074	.0101	.....	.....
25 7	**.0008**	.0058	.0610	.1546	.1526	.0570	**.0025**	.....	.....
24 8	**.0024**	.0142	.0952	.1610	.1101	.0254	**.0005**	.....	.....
23 9	.0065	.0295	.1270	.1431	.0677	.0097	**.0001**	.....	.....

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
22 10	.0150	.0527	.1460	.1097	.0360	**.0032**	------	------	------
21 11	.0300	.0820	.1460	.0732	.0166	**.0009**	------	------	------
20 12	.0526	.1117	.1278	.0427	.0067	**.0002**	------	------	------
19 13	.0809	.1336	.0983	.0219	**.0024**	------	------	------	------
18 14	.1098	.1410	.0667	.0099	**.0007**	------	------	------	------
17 15	.1317	.1316	.0400	.0040	**.0002**	------	------	------	------
16 16	.1399	.1088	.0213	**.0014**	**.0001**	------	------	------	------
15 17	.1317	.0796	.0100	**.0004**	------	------	------	------	------
14 18	.1098	.0516	.0042	**.0001**	------	------	------	------	------
13 19	.0809	.0296	**.0015**	------	------	------	------	------	------
12 20	.0526	.0150	**.0005**	------	------	------	------	------	------
11 21	.0300	.0066	**.0001**	------	------	------	------	------	------
10 22	.0150	**.0026**	------	------	------	------	------	------	------
9 23	.0065	**.0009**	------	------	------	------	------	------	------
8 24	**.0024**	**.0003**	------	------	------	------	------	------	------
7 25	**.0008**	**.0001**	------	------	------	------	------	------	------
6 26	**.0002**	------	------	------	------	------	------	------	------
5 27	------	------	------	------	------	------	------	------	------
4 28	------	------	------	------	------	------	------	------	------
	.9997	1.0001	.9999	1.0000	1.0000	.9999	1.0000	1.0000	1.0000
33 0	------	------	------	**.0001**	**.0011**	.0122	.1189	.5947	.8788
32 1	------	------	------	**.0008**	.0081	.0575	.2615	.3115	.1137
31 2	------	------	**.0002**	.0044	.0297	.1314	.2789	.0791	.0071
30 3	------	------	**.0011**	.0152	.0709	.1940	.1922	.0130	**.0003**
29 4	------	**.0001**	.0040	.0381	.1227	.2079	.0961	**.0015**	------
28 5	------	**.0004**	.0115	.0736	.1642	.1722	.0372	**.0001**	------
27 6	**.0001**	**.0014**	.0267	.1145	.1769	.1148	.0116	------	------
26 7	**.0005**	.0042	.0516	.1472	.1574	.0633	**.0030**	------	------
25 8	**.0016**	.0106	.0838	.1594	.1181	.0294	**.0006**	------	------
24 9	.0045	.0228	.1164	.1476	.0757	.0117	**.0001**	------	------
23 10	.0108	.0426	.1397	.1181	.0419	.0040	------	------	------
22 11	.0225	.0692	.1460	.0823	.0202	**.0012**	------	------	------
21 12	.0413	.0987	.1339	.0503	.0086	**.0003**	------	------	------
20 13	.0667	.1240	.1081	.0271	**.0032**	**.0001**	------	------	------
19 14	.0953	.1378	.0772	.0129	**.0011**	------	------	------	------
18 15	.1207	.1357	.0489	.0054	**.0003**	------	------	------	------
17 16	.1358	.1188	.0275	**.0020**	**.0001**	------	------	------	------
16 17	.1358	.0924	.0138	**.0007**	------	------	------	------	------
15 18	.1207	.0639	.0061	**.0002**	------	------	------	------	------
14 19	.0953	.0392	**.0024**	**.0001**	------	------	------	------	------
13 20	.0667	.0214	**.0008**	------	------	------	------	------	------
12 21	.0413	.0103	**.0003**	------	------	------	------	------	------
11 22	.0225	.0044	**.0001**	------	------	------	------	------	------
10 23	.0108	**.0016**	------	------	------	------	------	------	------
9 24	.0045	**.0005**	------	------	------	------	------	------	------
8 25	**.0016**	**.0001**	------	------	------	------	------	------	------
7 26	**.0005**	------	------	------	------	------	------	------	------
6 27	**.0001**	------	------	------	------	------	------	------	------
5 28	------	------	------	------	------	------	------	------	------
4 29	------	------	------	------	------	------	------	------	------
	.9996	1.0001	1.0001	1.0000	1.0002	1.0000	1.0001	.9999	.9999
34 0	------	------	------	**.0001**	**.0009**	.0107	.1114	.5854	.8754
33 1	------	------	------	**.0006**	.0067	.0518	.2526	.3159	.1167
32 2	------	------	**.0001**	**.0035**	.0257	.1222	.2778	.0827	.0076
31 3	------	------	**.0008**	.0125	.0632	.1862	.1976	.0140	**.0003**
30 4	------	**.0001**	**.0030**	.0324	.1130	.2061	.1021	**.0017**	------
29 5	------	**.0003**	.0090	.0647	.1564	.1767	.0408	**.0002**	------
28 6	**.0001**	**.0010**	.0217	.1042	.1745	.1220	.0132	------	------
27 7	**.0003**	**.0030**	.0433	.1390	.1611	.0697	**.0035**	------	------
26 8	**.0011**	.0078	.0731	.1564	.1254	.0336	**.0008**	------	------
25 9	**.0031**	.0174	.1055	.1506	.0836	.0139	**.0002**	------	------
24 10	.0076	.0339	.1319	.1255	.0482	.0050	------	------	------
23 11	.0167	.0576	.1439	.0913	.0243	**.0015**	------	------	------
22 12	.0319	.0858	.1379	.0583	.0107	**.0004**	------	------	------
21 13	.0540	.1129	.1167	.0329	.0042	**.0001**	------	------	------
20 14	.0810	.1318	.0875	.0164	**.0015**	------	------	------	------

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
19 15	.1080	.1366	.0584	.0073	**.0004**	.....	.....	.....	.....
18 16	.1283	.1262	.0346	**.0029**	.....	.....	.....	.....	.....
17 17	.1358	.1039	.0183	**.0010**	.....	.....	.....	.....	.....
16 18	.1283	.0763	.0087	**.0003**	.....	.....	.....	.....	.....
15 19	.1080	.0500	.0036	**.0001**	.....	.....	.....	.....	.....
14 20	.0810	.0292	**.0014**	.....	.....	.....	.....	.....	.....
13 21	.0540	.0151	**.0005**	.....	.....	.....	.....	.....	.....
12 22	.0319	.0070	**.0001**	.....	.....	.....	.....	.....	.....
11 23	.0167	**.0028**	.....	.....	.....	.....	.....	.....	.....
10 24	.0076	**.0010**	.....	.....	.....	.....	.....	.....	.....
9 25	**.0031**	**.0003**	.....	.....	.....	.....	.....	.....	.....
8 26	**.0011**	**.0001**	.....	.....	.....	.....	.....	.....	.....
7 27	**.0003**	.....	.....	.....	.....	.....	.....	.....	.....
6 28	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
5 29	.....	.....	.....	.....	.....	.....	.....	.....	.....
4 30	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0000	1.0001	1.0000	1.0000	.9998	.9999	1.0000	.9999	1.0000
35 0	.....	.....	.....	.....	**.0007**	.0093	.1045	.5763	.8720
34 1	.....	.....	.....	**.0005**	.0056	.0467	.2438	.3201	.1197
33 2	.....	.....	**.0001**	**.0028**	.0221	.1134	.2763	.0864	.0080
32 3	.....	.....	**.0006**	.0103	.0561	.1782	.2026	.0151	**.0003**
31 4	.....	.....	**.0022**	.0274	.1036	.2037	.1081	**.0019**	.....
30 5	.....	**.0002**	.0070	.0566	.1483	.1804	.0447	**.0002**	.....
29 6	.....	**.0006**	.0174	.0944	.1711	.1288	.0149	.....	.....
28 7	**.0002**	**.0021**	.0361	.1303	.1636	.0763	.0041	.....	.....
27 8	**.0007**	.0057	.0631	.1520	.1321	.0381	**.0010**	.....	.....
26 9	**.0021**	.0132	.0947	.1520	.0915	.0163	**.0002**	.....	.....
25 10	.0053	.0267	.1231	.1318	.0549	.0061	.....	.....	.....
24 11	.0121	.0472	.1399	.0998	.0288	**.0020**	.....	.....	.....
23 12	.0243	.0734	.1399	.0665	.0133	**.0006**	.....	.....	.....
22 13	.0430	.1011	.1238	.0392	.0054	**.0001**	.....	.....	.....
21 14	.0675	.1235	.0972	.0206	**.0020**	.....	.....	.....	.....
20 15	.0945	.1345	.0681	.0096	**.0006**	.....	.....	.....	.....
19 16	.1182	.1308	.0425	.0040	**.0002**	.....	.....	.....	.....
18 17	.1321	.1137	.0238	**.0015**	.....	.....	.....	.....	.....
17 18	.1321	.0884	.0119	**.0005**	.....	.....	.....	.....	.....
16 19	.1182	.0615	.0053	**.0001**	.....	.....	.....	.....	.....
15 20	.0945	.0383	**.0021**	.....	.....	.....	.....	.....	.....
14 21	.0675	.0213	**.0008**	.....	.....	.....	.....	.....	.....
13 22	.0430	.0105	**.0002**	.....	.....	.....	.....	.....	.....
12 23	.0243	.0046	**.0001**	.....	.....	.....	.....	.....	.....
11 24	.0121	**.0018**	.....	.....	.....	.....	.....	.....	.....
10 25	.0053	**.0006**	.....	.....	.....	.....	.....	.....	.....
9 26	**.0021**	**.0002**	.....	.....	.....	.....	.....	.....	.....
8 27	**.0007**	.....	.....	.....	.....	.....	.....	.....	.....
7 28	**.0002**	.....	.....	.....	.....	.....	.....	.....	.....
6 29	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 30	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0000	.9999	.9999	.9999	.9999	1.0000	1.0002	1.0000	1.0000
36 0	.....	.....	.....	.....	**.0006**	.0082	.0979	.5673	.8686
35 1	.....	.....	.....	**.0004**	.0047	.0420	.2351	.3241	.1226
34 2	.....	.....	**.0001**	**.0022**	.0190	.1051	.2742	.0900	.0084
33 3	.....	.....	**.0004**	.0084	.0498	.1701	.2072	.0162	**.0004**
32 4	.....	.....	**.0017**	.0231	.0947	.2005	.1140	**.0021**	.....
31 5	.....	**.0001**	.0054	.0493	.1399	.1833	.0486	**.0002**	.....
30 6	.....	**.0004**	.0139	.0849	.1668	.1353	.0167	.....	.....
29 7	**.0001**	**.0015**	.0299	.1213	.1650	.0828	.0048	.....	.....
28 8	**.0004**	.0041	.0541	.1466	.1380	.0429	**.0012**	.....	.....
27 9	**.0014**	.0099	.0842	.1520	.0991	.0191	**.0002**	.....	.....
26 10	.0037	.0208	.1136	.1368	.0617	.0074	.....	.....	.....
25 11	.0087	.0382	.1343	.1078	.0337	**.0025**	.....	.....	.....
24 12	.0182	.0620	.1399	.0749	.0162	**.0007**	.....	.....	.....
23 13	.0336	.0890	.1291	.0461	.0069	**.0002**	.....	.....	.....
22 14	.0552	.1137	.1061	.0252	**.0026**	.....	.....	.....	.....
21 15	.0810	.1297	.0778	.0123	**.0009**	.....	.....	.....	.....
20 16	.1063	.1324	.0511	.0054	**.0003**	.....	.....	.....	.....

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
19 17	.1251	.1212	.0300	**.0021**	**.0001**	.....	.....	.....	.....
18 18	.1321	.0995	.0159	**.0007**	.....	.....	.....	.....	.....
17 19	.1251	.0733	.0075	**.0002**	.....	.....	.....	.....	.....
16 20	.1063	.0485	**.0032**	**.0001**	.....	.....	.....	.....	.....
15 21	.0810	.0287	**.0012**	.....	.....	.....	.....	.....	.....
14 22	.0552	.0152	**.0004**	.....	.....	.....	.....	.....	.....
13 23	.0336	.0072	**.0001**	.....	.....	.....	.....	.....	.....
12 24	.0182	**.0030**	.....	.....	.....	.....	.....	.....	.....
11 25	.0087	**.0011**	.....	.....	.....	.....	.....	.....	.....
10 26	.0037	**.0004**	.....	.....	.....	.....	.....	.....	.....
9 27	**.0014**	**.0001**	.....	.....	.....	.....	.....	.....	.....
8 28	**.0004**	.....	.....	.....	.....	.....	.....	.....	.....
7 29	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
6 30	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 31	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.9995	1.0000	.9999	.9998	1.0000	1.0001	.9999	.9999	1.0000
37 0	.....	.....	.....	.....	**.0005**	.0072	.0918	.5584	.8652
36 1	.....	.....	.....	**.0003**	**.0039**	.0378	.2265	.3279	.1255
35 2	.....	.....	**.0001**	**.0018**	.0163	.0972	.2718	.0937	.0089
34 3	.....	.....	**.0003**	.0069	.0440	.1620	.2114	.0174	**.0004**
33 4	.....	.....	**.0013**	.0194	.0863	.1967	.1198	**.0023**	.....
32 5	.....	**.0001**	.0042	.0428	.1314	.1854	.0527	**.0002**	.....
31 6	.....	**.0003**	.0111	.0760	.1618	.1413	.0187	.....	.....
30 7	**.0001**	**.0010**	.0246	.1122	.1653	.0894	.0055	.....	.....
29 8	**.0003**	**.0029**	.0460	.1403	.1431	.0479	**.0014**	.....	.....
28 9	**.0009**	.0074	.0742	.1507	.1064	.0220	**.0003**	.....	.....
27 10	**.0025**	.0160	.1038	.1406	.0687	.0088	**.0001**	.....	.....
26 11	.0062	.0306	.1274	.1151	.0389	**.0031**	.....	.....	.....
25 12	.0135	.0516	.1380	.0831	.0195	**.0010**	.....	.....	.....
24 13	.0259	.0772	.1327	.0533	.0086	**.0003**	.....	.....	.....
23 14	.0444	.1029	.1138	.0304	.0034	**.0001**	.....	.....	.....
22 15	.0681	.1227	.0872	.0156	**.0012**	.....	.....	.....	.....
21 16	.0937	.1312	.0600	.0071	**.0004**	.....	.....	.....	.....
20 17	.1157	.1261	.0370	**.0029**	**.0001**	.....	.....	.....	.....
19 18	.1286	.1090	.0206	**.0011**	.....	.....	.....	.....	.....
18 19	.1286	.0847	.0103	**.0004**	.....	.....	.....	.....	.....
17 20	.1157	.0593	.0046	**.0001**	.....	.....	.....	.....	.....
16 21	.0937	.0374	**.0019**	.....	.....	.....	.....	.....	.....
15 22	.0681	.0211	**.0007**	.....	.....	.....	.....	.....	.....
14 23	.0444	.0107	**.0002**	.....	.....	.....	.....	.....	.....
13 24	.0259	.0049	**.0001**	.....	.....	.....	.....	.....	.....
12 25	.0135	**.0020**	.....	.....	.....	.....	.....	.....	.....
11 26	.0062	**.0007**	.....	.....	.....	.....	.....	.....	.....
10 27	**.0025**	**.0002**	.....	.....	.....	.....	.....	.....	.....
9 28	**.0009**	**.0001**	.....	.....	.....	.....	.....	.....	.....
8 29	**.0003**	.....	.....	.....	.....	.....	.....	.....	.....
7 30	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
6 31	.....	.....	.....	.....	.....	.....	.....	.....	.....
5 32	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.9998	1.0001	1.0001	1.0001	.9998	1.0002	1.0000	.9999	1.0000
38 0	.....	.....	.....	.....	**.0004**	.0063	.0861	.5496	.8618
37 1	.....	.....	.....	**.0002**	**.0033**	.0340	.2181	.3315	.1284
36 2	.....	.....	.....	**.0014**	.0140	.0898	.2690	.0974	.0093
35 3	.....	.....	**.0002**	.0056	.0388	.1539	.2152	.0185	**.0004**
34 4	.....	.....	**.0009**	.0163	.0784	.1923	.1255	**.0026**	.....
33 5	.....	.....	**.0032**	.0369	.1230	.1868	.0569	**.0003**	.....
32 6	.....	**.0002**	.0088	.0677	.1561	.1468	.0209	.....	.....
31 7	.....	**.0007**	.0201	.1032	.1647	.0959	.0064	.....	.....
30 8	**.0002**	**.0021**	.0389	.1333	.1472	.0531	**.0016**	.....	.....
29 9	**.0006**	.0054	.0648	.1481	.1133	.0253	**.0004**	.....	.....
28 10	**.0017**	.0122	.0939	.1431	.0758	.0105	**.0001**	.....	.....
27 11	.0044	.0242	.1196	.1214	.0445	.0038	.....	.....	.....
26 12	.0099	.0424	.1345	.0911	.0231	**.0012**	.....	.....	.....
25 13	.0197	.0660	.1345	.0607	.0107	**.0003**	.....	.....	.....
24 14	.0352	.0916	.1201	.0361	.0044	**.0001**	.....	.....	.....
23 15	.0563	.1140	.0961	.0193	**.0016**	.....	.....	.....	.....

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
22 16	.0809	.1275	.0691	.0092	**.0005**	.....	.....	.....	.....
21 17	.1047	.1283	.0447	.0040	**.0002**	.....	.....	.....	.....
20 18	.1222	.1164	.0261	**.0016**	.....	.....	.....	.....	.....
19 19	.1286	.0953	.0137	**.0005**	.....	.....	.....	.....	.....
18 20	.1222	.0704	.0065	**.0002**	.....	.....	.....	.....	.....
17 21	.1047	.0470	**.0028**	.....	.....	.....	.....	.....	.....
16 22	.0809	.0282	**.0011**	.....	.....	.....	.....	.....	.....
15 23	.0563	.0153	**.0004**	.....	.....	.....	.....	.....	.....
14 24	.0352	.0074	**.0001**	.....	.....	.....	.....	.....	.....
13 25	.0197	**.0032**	.....	.....	.....	.....	.....	.....	.....
12 26	.0099	**.0013**	.....	.....	.....	.....	.....	.....	.....
11 27	.0044	**.0004**	.....	.....	.....	.....	.....	.....	.....
10 28	**.0017**	**.0001**	.....	.....	.....	.....	.....	.....	.....
9 29	**.0006**	.....	.....	.....	.....	.....	.....	.....	.....
8 30	**.0002**	.....	.....	.....	.....	.....	.....	.....	.....
7 31	.....	.....	.....	.....	.....	.....	.....	.....	.....
6 32	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0002	.9996	1.0001	.9999	1.0000	1.0001	1.0002	.9999	.9999
39 0	.....	.....	.....	.....	**.0003**	.0055	.0807	.5411	.8584
38 1	.....	.....	.....	**.0002**	**.0027**	.0305	.2098	.3350	.1313
37 2	.....	.....	.....	**.0011**	.0120	.0828	.2658	.1010	.0098
36 3	.....	.....	**.0002**	.0045	.0342	.1459	.2185	.0198	**.0005**
35 4	.....	.....	**.0007**	.0136	.0710	.1875	.1311	**.0028**	.....
34 5	.....	.....	**.0024**	.0318	.1146	.1875	.0612	**.0003**	.....
33 6	.....	**.0001**	.0069	.0600	.1499	.1518	.0231	.....	.....
32 7	.....	**.0005**	.0163	.0943	.1631	.1022	.0073	.....	.....
31 8	**.0001**	**.0015**	.0326	.1257	.1505	.0584	**.0019**	.....	.....
30 9	**.0004**	.0040	.0562	.1444	.1196	.0287	**.0004**	.....	.....
29 10	**.0012**	.0093	.0842	.1444	.0828	.0123	**.0001**	.....	.....
28 11	**.0030**	.0190	.1110	.1269	.0504	.0046	.....	.....	.....
27 12	.0071	.0345	.1295	.0987	.0271	**.0015**	.....	.....	.....
26 13	.0148	.0557	.1345	.0683	.0130	**.0005**	.....	.....	.....
25 14	.0274	.0804	.1249	.0423	.0056	**.0001**	.....	.....	.....
24 15	.0457	.1042	.1041	.0235	**.0021**	.....	.....	.....	.....
23 16	.0686	.1216	.0781	.0117	**.0007**	.....	.....	.....	.....
22 17	.0928	.1280	.0528	.0053	**.0002**	.....	.....	.....	.....
21 18	.1134	.1216	.0323	**.0022**	**.0001**	.....	.....	.....	.....
20 19	.1254	.1046	.0178	**.0008**	.....	.....	.....	.....	.....
19 20	.1254	.0813	.0089	**.0003**	.....	.....	.....	.....	.....
18 21	.1134	.0572	.0040	**.0001**	.....	.....	.....	.....	.....
17 22	.0928	.0364	**.0017**	.....	.....	.....	.....	.....	.....
16 23	.0686	.0209	**.0006**	.....	.....	.....	.....	.....	.....
15 24	.0457	.0109	**.0002**	.....	.....	.....	.....	.....	.....
14 25	.0274	.0051	**.0001**	.....	.....	.....	.....	.....	.....
13 26	.0148	**.0021**	.....	.....	.....	.....	.....	.....	.....
12 27	.0071	**.0008**	.....	.....	.....	.....	.....	.....	.....
11 28	**.0030**	**.0003**	.....	.....	.....	.....	.....	.....	.....
10 29	**.0012**	**.0001**	.....	.....	.....	.....	.....	.....	.....
9 30	**.0004**	.....	.....	.....	.....	.....	.....	.....	.....
8 31	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
7 32	.....	.....	.....	.....	.....	.....	.....	.....	.....
6 33	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.9998	1.0001	1.0000	1.0001	.9999	.9998	.9999	1.0000	1.0000
40 0	.....	.....	.....	.....	**.0002**	**.0048**	.0757	.5326	.8551
39 1	.....	.....	.....	**.0001**	**.0023**	.0274	.2018	.3382	.1341
38 2	.....	.....	.....	**.0009**	.0103	.0763	.2623	.1047	.0103
37 3	.....	.....	**.0001**	**.0037**	.0300	.1380	.2215	.0210	**.0005**
36 4	.....	.....	**.0005**	.0113	.0641	.1823	.1366	**.0031**	.....
35 5	.....	.....	**.0019**	.0272	.1064	.1875	.0656	**.0004**	.....
34 6	.....	**.0001**	.0054	.0530	.1433	.1563	.0255	.....	.....
33 7	.....	**.0003**	.0132	.0857	.1606	.1084	.0083	.....	.....
32 8	**.0001**	**.0010**	.0272	.1179	.1529	.0639	**.0023**	.....	.....
31 9	**.0002**	**.0029**	.0483	.1397	.1254	.0325	**.0005**	.....	.....
30 10	**.0008**	.0069	.0749	.1444	.0897	.0144	**.0001**	.....	.....
29 11	**.0021**	.0147	.1021	.1312	.0565	.0056	.....	.....	.....
28 12	.0051	.0277	.1234	.1057	.0315	**.0019**	.....	.....	.....

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
27 13	.0109	.0464	.1328	.0759	.0157	**.0006**	.....	.....	.....
26 14	.0211	.0696	.1281	.0488	.0070	**.0002**	.....	.....	.....
25 15	.0366	.0938	.1110	.0282	**.0028**	.....	.....	.....	.....
24 16	.0572	.1140	.0867	.0147	**.0010**	.....	.....	.....	.....
23 17	.0807	.1252	.0612	.0069	**.0003**	.....	.....	.....	.....
22 18	.1031	.1244	.0391	**.0029**	**.0001**	.....	.....	.....	.....
21 19	.1194	.1120	.0227	**.0011**	.....	.....	.....	.....	.....
20 20	.1254	.0915	.0119	**.0004**	.....	.....	.....	.....	.....
19 21	.1194	.0678	.0057	**.0001**	.....	.....	.....	.....	.....
18 22	.1031	.0455	**.0024**	.....	.....	.....	.....	.....	.....
17 23	.0807	.0277	**.0010**	.....	.....	.....	.....	.....	.....
16 24	.0572	.0153	**.0003**	.....	.....	.....	.....	.....	.....
15 25	.0366	.0076	**.0001**	.....	.....	.....	.....	.....	.....
14 26	.0211	.0034	.....	.....	.....	.....	.....	.....	.....
13 27	.0109	**.0014**	.....	.....	.....	.....	.....	.....	.....
12 28	.0051	**.0005**	.....	.....	.....	.....	.....	.....	.....
11 29	**.0021**	**.0002**	.....	.....	.....	.....	.....	.....	.....
10 30	**.0008**	.....	.....	.....	.....	.....	.....	.....	.....
9 31	**.0002**	.....	.....	.....	.....	.....	.....	.....	.....
8 32	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
7 33	.....	.....	.....	.....	.....	.....	.....	.....	.....
6 34	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0000	.9999	1.0000	.9998	1.0001	1.0001	1.0002	1.0000	1.0000
41 0	.....	.....	.....	.....	**.0002**	**.0042**	.0709	.5243	.8517
40 1	.....	.....	.....	**.0001**	**.0019**	.0245	.1939	.3412	.1369
39 2	.....	.....	.....	**.0007**	.0088	.0701	.2585	.1083	.0107
38 3	.....	.....	**.0001**	**.0030**	.0263	.1303	.2240	.0224	**.0005**
37 4	.....	.....	**.0004**	.0094	.0577	.1768	.1419	**.0034**	.....
36 5	.....	.....	**.0014**	.0233	.0985	.1869	.0700	**.0004**	.....
35 6	.....	**.0001**	.0042	.0465	.1364	.1602	.0280	.....	.....
34 7	.....	**.0002**	.0106	.0775	.1573	.1144	.0093	.....	.....
33 8	.....	**.0007**	.0225	.1098	.1543	.0695	**.0026**	.....	.....
32 9	**.0002**	**.0021**	.0413	.1343	.1306	.0364	**.0006**	.....	.....
31 10	**.0005**	.0052	.0660	.1432	.0964	.0166	**.0001**	.....	.....
30 11	**.0014**	.0113	.0930	.1345	.0627	.0067	.....	.....	.....
29 12	.0036	.0220	.1163	.1121	.0362	**.0024**	.....	.....	.....
28 13	.0080	.0382	.1297	.0834	.0186	**.0008**	.....	.....	.....
27 14	.0160	.0594	.1297	.0556	.0086	**.0002**	.....	.....	.....
26 15	.0289	.0832	.1167	.0333	.0036	**.0001**	.....	.....	.....
25 16	.0469	.1052	.0948	.0181	**.0013**	.....	.....	.....	.....
24 17	.0689	.1203	.0697	.0089	**.0005**	.....	.....	.....	.....
23 18	.0919	.1247	.0465	.0039	**.0001**	.....	.....	.....	.....
22 19	.1113	.1174	.0281	**.0016**	.....	.....	.....	.....	.....
21 20	.1224	.1005	.0155	**.0006**	.....	.....	.....	.....	.....
20 21	.1224	.0782	.0077	**.0002**	.....	.....	.....	.....	.....
19 22	.1113	.0553	.0035	**.0001**	.....	.....	.....	.....	.....
18 23	.0919	.0355	**.0015**	.....	.....	.....	.....	.....	.....
17 24	.0689	.0207	**.0005**	.....	.....	.....	.....	.....	.....
16 25	.0469	.0110	**.0002**	.....	.....	.....	.....	.....	.....
15 26	.0289	.0052	**.0001**	.....	.....	.....	.....	.....	.....
14 27	.0160	**.0023**	.....	.....	.....	.....	.....	.....	.....
13 28	.0080	**.0009**	.....	.....	.....	.....	.....	.....	.....
12 29	.0036	**.0003**	.....	.....	.....	.....	.....	.....	.....
11 30	**.0014**	**.0001**	.....	.....	.....	.....	.....	.....	.....
10 31	**.0005**	.....	.....	.....	.....	.....	.....	.....	.....
9 32	**.0002**	.....	.....	.....	.....	.....	.....	.....	.....
8 33	.....	.....	.....	.....	.....	.....	.....	.....	.....
7 34	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0000	1.0000	1.0000	1.0001	1.0000	1.0001	.9998	1.0000	.9998
42 0	.....	.....	.....	.....	**.0002**	**.0037**	.0665	.5161	.8484
41 1	.....	.....	.....	**.0001**	**.0016**	.0220	.1862	.3441	.1397
40 2	.....	.....	.....	**.0005**	.0075	.0644	.2545	.1120	.0112
39 3	.....	.....	**.0001**	**.0024**	.0230	.1227	.2262	.0237	**.0006**
38 4	.....	.....	**.0003**	.0078	.0518	.1710	.1470	**.0037**	.....
37 5	.....	.....	**.0011**	.0198	.0908	.1856	.0745	**.0004**	.....
36 6	.....	.....	**.0033**	.0407	.1293	.1635	.0306	.....	.....

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
35 7	.....	**.0001**	.0085	.0698	.1534	.1201	.0105	.....	.....
34 8	.....	**.0005**	.0185	.1018	.1549	.0751	**.0031**	.....	.....
33 9	**.0001**	**.0015**	.0350	.1281	.1350	.0405	**.0008**	.....	.....
32 10	**.0003**	.0038	.0578	.1410	.1028	.0191	**.0002**	.....	.....
31 11	**.0010**	.0086	.0840	.1367	.0690	.0079	.....	.....	.....
30 12	**.0025**	.0173	.1085	.1177	.0412	**.0029**	.....	.....	.....
29 13	.0058	.0311	.1252	.0905	.0219	**.0010**	.....	.....	.....
28 14	.0120	.0502	.1297	.0625	.0105	**.0003**	.....	.....	.....
27 15	.0224	.0728	.1210	.0389	.0045	**.0001**	.....	.....	.....
26 16	.0379	.0956	.1021	.0219	**.0018**	.....	.....	.....	.....
25 17	.0579	.1137	.0781	.0112	**.0006**	.....	.....	.....	.....
24 18	.0804	.1228	.0542	.0052	**.0002**	.....	.....	.....	.....
23 19	.1016	.1206	.0343	**.0022**	**.0001**	.....	.....	.....	.....
22 20	.1168	.1079	.0197	**.0008**	.....	.....	.....	.....	.....
21 21	.1224	.0879	.0103	**.0003**	.....	.....	.....	.....	.....
20 22	.1168	.0653	.0049	**.0001**	.....	.....	.....	.....	.....
19 23	.1016	.0442	**.0021**	.....	.....	.....	.....	.....	.....
18 24	.0804	.0272	**.0008**	.....	.....	.....	.....	.....	.....
17 25	.0579	.0152	**.0003**	.....	.....	.....	.....	.....	.....
16 26	.0379	.0077	**.0001**	.....	.....	.....	.....	.....	.....
15 27	.0224	.0036	.....	.....	.....	.....	.....	.....	.....
14 28	.0120	**.0015**	.....	.....	.....	.....	.....	.....	.....
13 29	.0058	**.0006**	.....	.....	.....	.....	.....	.....	.....
12 30	**.0025**	**.0002**	.....	.....	.....	.....	.....	.....	.....
11 31	**.0010**	**.0001**	.....	.....	.....	.....	.....	.....	.....
10 32	**.0003**	.....	.....	.....	.....	.....	.....	.....	.....
9 33	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
8 34	.....	.....	.....	.....	.....	.....	.....	.....	.....
7 35	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.9998	1.0000	.9999	1.0000	1.0001	.9999	1.0001	1.0000	.9999
43 0	.....	.....	.....	.....	**.0001**	**.0032**	.0623	.5080	.8451
42 1	.....	.....	.....	**.0001**	**.0013**	.0197	.1787	.3468	.1425
41 2	.....	.....	.....	**.0004**	.0064	.0591	.2502	.1156	.0117
40 3	.....	.....	.....	**.0019**	.0201	.1155	.2280	.0251	**.0006**
39 4	.....	.....	**.0002**	.0065	.0464	.1649	.1520	**.0040**	.....
38 5	.....	.....	**.0008**	.0168	.0835	.1838	.0790	**.0005**	.....
37 6	.....	.....	**.0026**	.0355	.1221	.1663	.0334	.....	.....
36 7	.....	**.0001**	.0067	.0625	.1489	.1256	.0118	.....	.....
35 8	.....	**.0003**	.0152	.0938	.1546	.0807	**.0035**	.....	.....
34 9	**.0001**	**.0011**	.0295	.1216	.1387	.0448	**.0009**	.....	.....
33 10	**.0002**	**.0028**	.0502	.1378	.1089	.0218	**.0002**	.....	.....
32 11	**.0007**	.0065	.0753	.1378	.0754	.0093	.....	.....	.....
31 12	**.0017**	.0135	.1003	.1225	.0464	.0036	.....	.....	.....
30 13	.0042	.0251	.1196	.0973	.0255	**.0012**	.....	.....	.....
29 14	.0089	.0418	.1282	.0695	.0126	**.0004**	.....	.....	.....
28 15	.0172	.0629	.1239	.0448	.0056	**.0001**	.....	.....	.....
27 16	.0302	.0856	.1084	.0261	**.0023**	.....	.....	.....	.....
26 17	.0479	.1057	.0861	.0138	**.0008**	.....	.....	.....	.....
25 18	.0692	.1188	.0622	.0067	**.0003**	.....	.....	.....	.....
24 19	.0910	.1216	.0409	**.0029**	**.0001**	.....	.....	.....	.....
23 20	.1092	.1135	.0246	**.0012**	.....	.....	.....	.....	.....
22 21	.1196	.0967	.0134	**.0004**	.....	.....	.....	.....	.....
21 22	.1196	.0752	.0067	**.0001**	.....	.....	.....	.....	.....
20 23	.1092	.0534	.0031	.....	.....	.....	.....	.....	.....
19 24	.0910	.0346	**.0013**	.....	.....	.....	.....	.....	.....
18 25	.0692	.0205	**.0005**	.....	.....	.....	.....	.....	.....
17 26	.0479	.0110	**.0002**	.....	.....	.....	.....	.....	.....
16 27	.0302	.0054	**.0001**	.....	.....	.....	.....	.....	.....
15 28	.0172	**.0024**	.....	.....	.....	.....	.....	.....	.....
14 29	.0089	**.0010**	.....	.....	.....	.....	.....	.....	.....
13 30	.0042	**.0004**	.....	.....	.....	.....	.....	.....	.....
12 31	**.0017**	**.0001**	.....	.....	.....	.....	.....	.....	.....
11 32	**.0007**	.....	.....	.....	.....	.....	.....	.....	.....
10 33	**.0002**	.....	.....	.....	.....	.....	.....	.....	.....
9 34	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
8 35	.....	.....	.....	.....	.....	.....	.....	.....	.....
7 36	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0002	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	.9999

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
44 0	------	------	------	------	.0001	.0028	.0584	.5001	.8418
43 1	------	------	------	------	.0011	.0176	.1714	.3493	.1453
42 2	------	------	------	.0003	.0054	.0542	.2457	.1192	.0122
41 3	------	------	------	.0016	.0175	.1084	.2293	.0265	.0007
40 4	------	------	.0002	.0053	.0415	.1587	.1567	.0043	------
39 5	------	------	.0006	.0142	.0766	.1814	.0836	.0005	------
38 6	------	------	.0020	.0308	.1148	.1685	.0362	.0001	------
37 7	------	.0001	.0053	.0558	.1438	.1306	.0131	------	------
36 8	------	.0002	.0124	.0860	.1535	.0863	.0040	------	------
35 9	------	.0007	.0247	.1146	.1417	.0493	.0011	------	------
34 10	.0001	.0020	.0433	.1337	.1145	.0247	.0003	------	------
33 11	.0004	.0049	.0669	.1378	.0817	.0109	.0001	------	------
32 12	.0012	.0105	.0920	.1263	.0518	.0043	------	------	------
31 13	.0030	.0200	.1132	.1036	.0294	.0015	------	------	------
30 14	.0065	.0345	.1253	.0765	.0150	.0005	------	------	------
29 15	.0131	.0537	.1253	.0510	.0069	.0001	------	------	------
28 16	.0237	.0757	.1136	.0308	.0029	------	------	------	------
27 17	.0390	.0969	.0936	.0169	.0011	------	------	------	------
26 18	.0585	.1131	.0702	.0085	.0004	------	------	------	------
25 19	.0801	.1204	.0480	.0039	.0001	------	------	------	------
24 20	.1001	.1170	.0300	.0016	------	------	------	------	------
23 21	.1144	.1040	.0171	.0006	------	------	------	------	------
22 22	.1196	.0846	.0090	.0002	------	------	------	------	------
21 23	.1144	.0629	.0043	.0001	------	------	------	------	------
20 24	.1001	.0428	.0019	------	------	------	------	------	------
19 25	.0801	.0267	.0008	------	------	------	------	------	------
18 26	.0585	.0152	.0003	------	------	------	------	------	------
17 27	.0390	.0079	.0001	------	------	------	------	------	------
16 28	.0237	.0037	------	------	------	------	------	------	------
15 29	.0131	.0016	------	------	------	------	------	------	------
14 30	.0065	.0006	------	------	------	------	------	------	------
13 31	.0030	.0002	------	------	------	------	------	------	------
12 32	.0012	.0001	------	------	------	------	------	------	------
11 33	.0004	------	------	------	------	------	------	------	------
10 34	.0001	------	------	------	------	------	------	------	------
9 35	------	------	------	------	------	------	------	------	------
8 36	------	------	------	------	------	------	------	------	------
	.9998	1.0000	1.0001	1.0001	.9998	.9998	.9999	1.0000	1.0000
45 0	------	------	------	------	.0001	.0025	.0548	.4923	.8385
44 1	------	------	------	------	.0009	.0158	.1644	.3516	.1480
43 2	------	------	------	.0003	.0046	.0496	.2411	.1228	.0128
42 3	------	------	------	.0013	.0153	.1016	.2304	.0279	.0007
41 4	------	------	.0001	.0044	.0370	.1525	.1613	.0047	------
40 5	------	------	.0005	.0120	.0700	.1786	.0882	.0006	------
39 6	------	------	.0015	.0267	.1077	.1701	.0392	.0001	------
38 7	------	------	.0042	.0495	.1384	.1354	.0146	------	------
37 8	------	.0002	.0100	.0784	.1517	.0919	.0046	------	------
36 9	------	.0005	.0206	.1074	.1439	.0540	.0013	------	------
35 10	.0001	.0015	.0371	.1289	.1196	.0277	.0003	------	------
34 11	.0003	.0036	.0590	.1367	.0878	.0126	.0001	------	------
33 12	.0008	.0080	.0836	.1291	.0574	.0051	------	------	------
32 13	.0021	.0159	.1061	.1093	.0336	.0019	------	------	------
31 14	.0047	.0282	.1213	.0833	.0177	.0006	------	------	------
30 15	.0098	.0453	.1253	.0574	.0085	.0002	------	------	------
29 16	.0184	.0661	.1175	.0359	.0037	------	------	------	------
28 17	.0314	.0876	.1002	.0204	.0014	------	------	------	------
27 18	.0488	.1060	.0780	.0106	.0005	------	------	------	------
26 19	.0693	.1172	.0554	.0050	.0002	------	------	------	------
25 20	.0899	.1185	.0360	.0022	.0001	------	------	------	------
24 21	.1073	.1097	.0214	.0009	------	------	------	------	------
23 22	.1170	.0931	.0117	.0003	------	------	------	------	------
22 23	.1170	.0724	.0058	.0001	------	------	------	------	------
21 24	.1073	.0516	.0027	------	------	------	------	------	------
20 25	.0899	.0337	.0011	------	------	------	------	------	------
19 26	.0693	.0202	.0004	------	------	------	------	------	------
18 27	.0488	.0110	.0002	------	------	------	------	------	------
17 28	.0314	.0055	------	------	------	------	------	------	------
16 29	.0184	.0025	------	------	------	------	------	------	------

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	D	R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
45	30		.0098	**.0010**	.....	.....	.....	.....	.....	.....	.....
14	31		.0047	**.0004**	.....	.....	.....	.....	.....	.....	.....
13	32		**.0021**	**.0001**	.....	.....	.....	.....	.....	.....	.....
12	33		**.0008**	.....	.....	.....	.....	.....	.....	.....	.....
11	34		**.0003**	.....	.....	.....	.....	.....	.....	.....	.....
10	35		**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
9	36		.....	.....	.....	.....	.....	.....	.....	.....	.....
8	37		.....	.....	.....	.....	.....	.....	.....	.....	.....
			.9998	.9998	.9997	1.0001	1.0001	1.0001	1.0003	1.0000	1.0000
46	0		.....	.....	.....	.....	**.0001**	**.0021**	.0514	.4846	.8352
45	1		.....	.....	.....	.....	**.0008**	.0141	.1575	.3538	.1507
44	2		.....	.....	.....	**.0002**	**.0039**	.0454	.2363	.1264	.0133
43	3		.....	.....	.....	**.0010**	.0133	.0951	.2310	.0294	**.0008**
42	4		.....	.....	**.0001**	**.0036**	.0329	.1461	.1656	.0050	.....
41	5		.....	.....	**.0003**	.0101	.0638	.1753	.0927	**.0007**	.....
40	6		.....	.....	**.0012**	.0230	.1006	.1711	.0422	**.0001**	.....
39	7		.....	.....	**.0033**	.0438	.1326	.1397	.0161	.....	.....
38	8		.....	**.0001**	.0081	.0712	.1492	.0973	.0052	.....	.....
37	9		.....	**.0004**	.0171	.1002	.1454	.0587	**.0015**	.....	.....
36	10		**.0001**	**.0011**	.0316	.1236	.1241	.0310	**.0004**	.....	.....
35	11		**.0002**	**.0027**	.0517	.1348	.0938	.0145	**.0001**	.....	.....
34	12		**.0006**	.0061	.0754	.1310	.0631	.0060	.....	.....	.....
33	13		**.0014**	.0124	.0986	.1142	.0381	**.0023**	.....	.....	.....
32	14		.0034	.0228	.1162	.0898	.0207	**.0008**	.....	.....	.....
31	15		.0073	.0378	.1240	.0638	.0102	**.0002**	.....	.....	.....
30	16		.0141	.0570	.1201	.0412	.0046	**.0001**	.....	.....	.....
29	17		.0249	.0782	.1060	.0243	**.0019**	.....	.....	.....	.....
28	18		.0401	.0980	.0854	.0130	**.0007**	.....	.....	.....	.....
27	19		.0590	.1123	.0629	.0064	**.0002**	.....	.....	.....	.....
26	20		.0797	.1179	.0425	**.0029**	**.0001**	.....	.....	.....	.....
25	21		.0987	.1135	.0263	**.0012**	.....	.....	.....	.....	.....
24	22		.1121	.1004	.0149	**.0005**	.....	.....	.....	.....	.....
23	23		.1170	.0815	.0078	**.0002**	.....	.....	.....	.....	.....
22	24		.1121	.0607	.0037	**.0001**	.....	.....	.....	.....	.....
21	25		.0987	.0416	**.0016**	.....	.....	.....	.....	.....	.....
20	26		.0797	.0261	**.0007**	.....	.....	.....	.....	.....	.....
19	27		.0590	.0150	**.0002**	.....	.....	.....	.....	.....	.....
18	28		.0401	.0079	**.0001**	.....	.....	.....	.....	.....	.....
17	29		.0249	.0038	.....	.....	.....	.....	.....	.....	.....
16	30		.0141	**.0017**	.....	.....	.....	.....	.....	.....	.....
15	31		.0073	**.0007**	.....	.....	.....	.....	.....	.....	.....
14	32		.0034	**.0002**	.....	.....	.....	.....	.....	.....	.....
13	33		**.0014**	**.0001**	.....	.....	.....	.....	.....	.....	.....
12	34		**.0006**	.....	.....	.....	.....	.....	.....	.....	.....
11	35		**.0002**	.....	.....	.....	.....	.....	.....	.....	.....
10	36		**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
9	37		.....	.....	.....	.....	.....	.....	.....	.....	.....
8	38		.....	.....	.....	.....	.....	.....	.....	.....	.....
			1.0002	1.0000	.9998	1.0001	1.0001	.9998	1.0000	1.0000	1.0000
47	0		.....	.....	.....	.....	**.0001**	**.0019**	.0482	.4770	.8320
46	1		.....	.....	.....	.....	**.0006**	.0126	.1509	.3559	.1533
45	2		.....	.....	.....	**.0002**	**.0033**	.0415	.2314	.1299	.0138
44	3		.....	.....	.....	**.0008**	.0115	.0889	.2314	.0309	**.0008**
43	4		.....	.....	**.0001**	**.0030**	.0292	.1397	.1697	.0054	.....
42	5		.....	.....	**.0003**	.0085	.0580	.1717	.0973	**.0007**	.....
41	6		.....	.....	**.0009**	.0198	.0937	.1717	.0454	**.0001**	.....
40	7		.....	.....	**.0026**	.0386	.1266	.1436	.0177	.....	.....
39	8		.....	**.0001**	.0065	.0643	.1461	.1026	.0059	.....	.....
38	9		.....	**.0003**	.0141	.0929	.1461	.0635	**.0017**	.....	.....
37	10		.....	**.0008**	.0268	.1177	.1281	.0345	**.0004**	.....	.....
36	11		**.0001**	**.0020**	.0450	.1320	.0995	.0166	**.0001**	.....	.....
35	12		**.0004**	.0046	.0675	.1320	.0689	.0071	.....	.....	.....
34	13		**.0010**	.0097	.0909	.1184	.0428	**.0027**	.....	.....	.....
33	14		**.0024**	.0183	.1104	.0959	.0240	**.0009**	.....	.....	.....
32	15		.0053	.0312	.1214	.0703	.0122	**.0003**	.....	.....	.....

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
31 16	.0107	.0486	.1214	.0469	.0056	**.0001**	.....	.....	.....
30 17	.0195	.0689	.1107	.0285	**.0024**	.....	.....	.....	.....
29 18	.0325	.0893	.0923	.0158	**.0009**	.....	.....	.....	.....
28 19	.0496	.1060	.0704	.0081	**.0003**	.....	.....	.....	.....
27 20	.0694	.1155	.0493	.0038	**.0001**	.....	.....	.....	.....
26 21	.0892	.1155	.0317	**.0016**	.....	.....	.....	.....	.....
25 22	.1054	.1061	.0187	**.0006**	.....	.....	.....	.....	.....
24 23	.1146	.0897	.0102	**.0002**	.....	.....	.....	.....	.....
23 24	.1146	.0698	.0051	**.0001**	.....	.....	.....	.....	.....
22 25	.1054	.0499	**.0023**	.....	.....	.....	.....	.....	.....
21 26	.0892	.0329	**.0010**	.....	.....	.....	.....	.....	.....
20 27	.0694	.0199	**.0004**	.....	.....	.....	.....	.....	.....
19 28	.0496	.0110	**.0001**	.....	.....	.....	.....	.....	.....
18 29	.0325	.0056	.....	.....	.....	.....	.....	.....	.....
17 30	.0195	**.0026**	.....	.....	.....	.....	.....	.....	.....
16 31	.0107	**.0011**	.....	.....	.....	.....	.....	.....	.....
15 32	.0053	**.0004**	.....	.....	.....	.....	.....	.....	.....
14 33	**.0024**	**.0002**	.....	.....	.....	.....	.....	.....	.....
13 34	**.0010**	.....	.....	.....	.....	.....	.....	.....	.....
12 35	**.0004**	.....	.....	.....	.....	.....	.....	.....	.....
11 36	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
10 37	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 38	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0002	1.0000	1.0001	1.0000	1.0000	.9999	1.0001	.9999	.9999
48 0	.....	.....	.....	.....	.....	**.0016**	.0452	.4696	.8287
47 1	.....	.....	.....	.....	**.0005**	.0113	.1445	.3578	.1560
46 2	.....	.....	.....	**.0001**	**.0028**	.0379	.2263	.1335	.0144
45 3	.....	.....	.....	**.0006**	.0100	.0830	.2314	.0325	**.0009**
44 4	.....	.....	.....	**.0024**	.0259	.1334	.1735	.0058	.....
43 5	.....	.....	**.0002**	.0071	.0526	.1677	.1018	**.0008**	.....
42 6	.....	.....	**.0007**	.0170	.0870	.1717	.0486	**.0001**	.....
41 7	.....	.....	**.0020**	.0339	.1205	.1471	.0195	.....	.....
40 8	.....	**.0001**	.0052	.0579	.1425	.1077	.0066	.....	.....
39 9	.....	**.0002**	.0116	.0858	.1461	.0684	**.0020**	.....	.....
38 10	.....	**.0005**	.0225	.1115	.1315	.0381	**.0005**	.....	.....
37 11	**.0001**	**.0014**	.0389	.1284	.1048	.0188	**.0001**	.....	.....
36 12	**.0002**	.0035	.0600	.1320	.0746	.0083	.....	.....	.....
35 13	**.0007**	.0075	.0831	.1218	.0477	**.0033**	.....	.....	.....
34 14	**.0017**	.0145	.1039	.1015	.0275	**.0012**	.....	.....	.....
33 15	.0039	.0256	.1177	.0767	.0144	**.0004**	.....	.....	.....
32 16	.0080	.0410	.1214	.0527	.0068	**.0001**	.....	.....	.....
31 17	.0151	.0600	.1143	.0331	**.0030**	.....	.....	.....	.....
30 18	.0260	.0804	.0984	.0190	**.0012**	.....	.....	.....	.....
29 19	.0410	.0987	.0777	.0100	**.0004**	.....	.....	.....	.....
28 20	.0595	.1113	.0563	.0048	**.0001**	.....	.....	.....	.....
27 21	.0793	.1155	.0376	**.0021**	.....	.....	.....	.....	.....
26 22	.0973	.1102	.0230	**.0009**	.....	.....	.....	.....	.....
25 23	.1100	.0969	.0130	**.0003**	.....	.....	.....	.....	.....
24 24	.1146	.0785	.0068	**.0001**	.....	.....	.....	.....	.....
23 25	.1100	.0586	.0033	.....	.....	.....	.....	.....	.....
22 26	.0973	.0403	**.0014**	.....	.....	.....	.....	.....	.....
21 27	.0793	.0256	**.0006**	.....	.....	.....	.....	.....	.....
20 28	.0595	.0149	**.0002**	.....	.....	.....	.....	.....	.....
19 29	.0410	.0080	**.0001**	.....	.....	.....	.....	.....	.....
18 30	.0260	.0039	.....	.....	.....	.....	.....	.....	.....
17 31	.0151	**.0018**	.....	.....	.....	.....	.....	.....	.....
16 32	.0080	**.0007**	.....	.....	.....	.....	.....	.....	.....
15 33	.0039	**.0003**	.....	.....	.....	.....	.....	.....	.....
14 34	**.0017**	**.0001**	.....	.....	.....	.....	.....	.....	.....
13 35	**.0007**	.....	.....	.....	.....	.....	.....	.....	.....
12 36	**.0002**	.....	.....	.....	.....	.....	.....	.....	.....
11 37	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
10 38	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 39	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1.0002	1.0000	.9999	.9997	.9999	1.0000	1.0000	1.0001	1.0000
49 0	.....	.....	.....	.....	.....	**.0014**	.0423	.4622	.8255
48 1	.....	.....	.....	.....	**.0004**	.0101	.1383	.3595	.1586

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios 1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
47 2	------	------	------	**.0001**	**.0024**	.0346	.2212	.1370	.0149
46 3	------	------	------	**.0005**	.0086	.0774	.2310	.0341	**.0009**
45 4	------	------	------	**.0020**	.0229	.1271	.1771	.0062	------
44 5	------	------	**.0001**	.0059	.0476	.1634	.1063	**.0009**	------
43 6	------	------	**.0005**	.0145	.0806	.1712	.0520	**.0001**	------
42 7	------	------	**.0016**	.0297	.1142	.1502	.0213	------	------
41 8	------	------	.0041	.0519	.1383	.1127	.0074	------	------
40 9	------	**.0001**	.0094	.0788	.1454	.0733	**.0023**	------	------
39 10	------	**.0004**	.0189	.1051	.1342	.0419	**.0006**	------	------
38 11	**.0001**	**.0010**	.0335	.1242	.1098	.0212	**.0002**	------	------
37 12	**.0002**	**.0026**	.0530	.1311	.0803	.0096	------	------	------
36 13	**.0005**	.0057	.0754	.1244	.0527	.0039	------	------	------
35 14	**.0012**	.0114	.0970	.1066	.0313	**.0014**	------	------	------
34 15	**.0028**	.0207	.1131	.0829	.0168	**.0005**	------	------	------
33 16	.0059	.0342	.1202	.0587	.0083	**.0001**	------	------	------
32 17	.0116	.0517	.1166	.0380	.0037	------	------	------	------
31 18	.0205	.0715	.1037	.0225	**.0015**	------	------	------	------
30 19	.0335	.0907	.0846	.0123	**.0006**	------	------	------	------
29 20	.0502	.1058	.0634	.0061	**.0002**	------	------	------	------
28 21	.0694	.1137	.0438	**.0028**	**.0001**	------	------	------	------
27 22	.0883	.1125	.0279	**.0012**	------	------	------	------	------
26 23	.1036	.1027	.0164	**.0005**	------	------	------	------	------
25 24	.1123	.0866	.0089	**.0002**	------	------	------	------	------
24 25	.1123	.0673	.0044	**.0001**	------	------	------	------	------
23 26	.1036	.0483	**.0020**	------	------	------	------	------	------
22 27	.0883	.0320	**.0009**	------	------	------	------	------	------
21 28	.0694	.0196	**.0003**	------	------	------	------	------	------
20 29	.0502	.0110	**.0001**	------	------	------	------	------	------
19 30	.0335	.0057	------	------	------	------	------	------	------
18 31	.0205	**.0027**	------	------	------	------	------	------	------
17 32	.0116	**.0012**	------	------	------	------	------	------	------
16 33	.0059	**.0005**	------	------	------	------	------	------	------
15 34	**.0028**	**.0002**	------	------	------	------	------	------	------
14 35	**.0012**	**.0001**	------	------	------	------	------	------	------
13 36	**.0005**	------	------	------	------	------	------	------	------
12 37	**.0002**	------	------	------	------	------	------	------	------
11 38	**.0001**	------	------	------	------	------	------	------	------
10 39	------	------	------	------	------	------	------	------	------
9 40	------	------	------	------	------	------	------	------	------
	1.0002	.9999	.9998	1.0001	.9999	1.0000	1.0000	1.0000	.9999
50 0	------	------	------	------	------	**.0013**	.0397	.4550	.8223
49 1	------	------	------	------	**.0004**	.0090	.1323	.3611	.1612
48 2	------	------	------	**.0001**	**.0020**	.0315	.2160	.1404	.0155
47 3	------	------	------	**.0004**	.0075	.0720	.2304	.0357	**.0010**
46 4	------	------	------	**.0016**	.0202	.1209	.1805	.0067	------
45 5	------	------	**.0001**	.0049	.0430	.1589	.1107	**.0010**	------
44 6	------	------	**.0004**	.0123	.0744	.1702	.0554	**.0001**	------
43 7	------	------	**.0012**	.0259	.1079	.1528	.0232	------	------
42 8	------	------	**.0033**	.0463	.1338	.1174	.0083	------	------
41 9	------	**.0001**	.0077	.0721	.1441	.0782	**.0026**	------	------
40 10	------	**.0003**	.0157	.0985	.1363	.0458	**.0007**	------	------
39 11	------	**.0008**	.0286	.1194	.1144	.0238	**.0002**	------	------
38 12	**.0001**	**.0019**	.0465	.1294	.0858	.0111	------	------	------
37 13	**.0003**	.0043	.0679	.1261	.0579	**.0046**	------	------	------
36 14	**.0008**	.0089	.0898	.1110	.0353	**.0017**	------	------	------
35 15	**.0020**	.0167	.1077	.0888	.0196	**.0006**	------	------	------
34 16	.0044	.0283	.1178	.0648	.0099	**.0002**	------	------	------
33 17	.0087	.0441	.1178	.0432	.0046	**.0001**	------	------	------
32 18	.0160	.0628	.1080	.0264	**.0019**	------	------	------	------
31 19	.0270	.0823	.0910	.0148	**.0007**	------	------	------	------
30 20	.0419	.0992	.0705	.0077	**.0003**	------	------	------	------
29 21	.0598	.1102	.0504	.0036	**.0001**	------	------	------	------
28 22	.0788	.1130	.0332	**.0016**	------	------	------	------	------
27 23	.0960	.1070	.0202	**.0006**	------	------	------	------	------
26 24	.1080	.0936	.0114	**.0002**	------	------	------	------	------
25 25	.1123	.0757	.0059	**.0001**	------	------	------	------	------
24 26	.1080	.0566	**.0028**	------	------	------	------	------	------
23 27	.0960	.0392	**.0013**	------	------	------	------	------	------

Table 4. Probabilities of Mendelian Ratios.—(Continued).

The group of combinations at each end of each expansion is set off so as to show the point beyond which the total probability in that direction is .0050 or less.

Combination D+R	Mendelian Ratios								
	1:1	9:7	2:1	3:1	13:3	7:1	15:1	63:1	255:1
22 28	.0788	.0250	**.0005**	.....	.....	.....	.....	.....	.....
21 29	.0598	.0148	**.0002**	.....	.....	.....	.....	.....	.....
20 30	.0419	.0080	**.0001**	.....	.....	.....	.....	.....	.....
19 31	.0270	.0040	.....	.....	.....	.....	.....	.....	.....
18 32	.0160	**.0019**	.....	.....	.....	.....	.....	.....	.....
17 33	.0087	**.0008**	.....	.....	.....	.....	.....	.....	.....
16 34	.0044	**.0003**	.....	.....	.....	.....	.....	.....	.....
15 35	**.0020**	**.0001**	.....	.....	.....	.....	.....	.....	.....
14 36	**.0008**	.....	.....	.....	.....	.....	.....	.....	.....
13 37	**.0003**	.....	.....	.....	.....	.....	.....	.....	.....
12 38	**.0001**	.....	.....	.....	.....	.....	.....	.....	.....
11 39	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 40	.....	.....	.....	.....	.....	.....	.....	.....	.....
	.9999	.9999	1.0000	.9998	1.0001	1.0001	1.0000	1.0000	1.0000

Table 5. Limits of Variation of Mendelian Ratios

Any values **outside** the limits are extremely unlikely, i. e., .0050 or less in upper and lower directions respectively. The numbers represent the number of recessives possible **within** the limits. This table gives the ratios which were not completed in Table 4, with their values from n=50 up to the point where the probability of n dominants +O recessives is less than .0001.

Mendelian Ratios							
7:1		15:1		63:1		255:1	
n	No. recessives	n	No. recessives	n	No. recessives	n	No. recessives
50–53	1–13	50–52	0–8	50–70	0–4	50–87	0–2
54–56	1–14	53–62	0–9	71–100	0–5	88–173	0–3
57–58	2–14	63–72	0–10	101–132	0–6	174–278	0–4
59–64	2–15	73–82	0–11	133–166	0–7	279–395	0–5
65–70	2–16	83–92	1–12	167–203	0–8	396–525	0–6
71–75	3–17	93–103	1–13	204–241	0–9	526–661	0–7
.....	.....	104–113	1–14	242–280	0–10	662–806	0–8
.....	.....	114–115	1–15	281–320	0–11	807–955	0–9
.....	.....	116–124	2–15	321–335	0–12	956–1113	0–10
.....	.....	125–136	2–16	336–360	1–12	1114–1274	0–11
.....	.....	137–144	2–17	361–402	1–13	1275–1356	0–12
.....	.....	145–147	3–17	403–444	1–14	1357–1430	1–12
.....	.....	148–153	3–18	445–471	1–15	1431–1599	1–13
.....	.....	.....	.....	472–489	2–15	1600–1769	1–14
.....	.....	.....	.....	490–532	2–16	1770–1896	1–15
.....	.....	.....	.....	533–578	2–17	1897–1946	2–15
.....	.....	.....	.....	579–589	2–18	1947–2120	2–16
.....	.....	.....	.....	590–622	3–18	2121–2298	2–17
.....	.....	.....	.....	623–629	3–19	2299–2369	2–18
.....	.....	.....	.....	.....	.....	2370–2479	3–18
.....	.....	.....	.....	.....	.....	2480–2531	3–19